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*Cover Photograph*

Hertfordshire homestead in the Lea Valley, near Wormley



# AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LX No. 6 SEPTEMBER 1953

## HIGHER FARMING FOR HIGHER PROFITS

PROFESSOR SIR JAMES A. SCOTT WATSON, C.B.E., LL.D.
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*Ministry of Agriculture and Fisheries*

Getting the extra return per acre may not be easy, but it can be profitable.

IT is common knowledge that, as a nation, we are still in difficulty about paying our way and, in particular, meeting our bills for imported food and essential raw materials. Our balance of income and expenditure is still a precarious one. There are two things that we can do. The one is to export more—more motor cars and ships and machines, more textiles, and so forth. The other is to produce, at home, more of our necessities ; and since the heaviest of all our bills is for imported food, our biggest potential import-saver is our land. We are already producing from our soil half as much again as we did before the war, and it seems that no other country could say as much. In any case, the world's farmers, as a whole, can claim no more than a 10 per cent increase over the same period.

There are real difficulties in the way of a further expansion of food production. In some cases the chief obstacle is shortage of workers, or of tolerable houses for them to live in. In others, it is hard to find the money for improved drainage, farm roads, fences, water supplies, or buildings, or for the additional machinery that is needed, or the extra head of livestock that could be carried. In still other cases, the want of electric power is holding back development.

But there is a real incentive to struggle against such difficulties—namely that, by and large, higher production would make for higher profits. This is clearly borne out by the mass of financial data that is collected year by year by our farm economists. A large proportion of our land is being farmed below the level that would provide the maximum income to the farmer.

The big crop, indeed, costs more to produce than the little one ; the good ley is more expensive than the poor old pasture ; the thousand-gallon cow costs more to keep than the five-hundred galloner. But in each case the extra expense is far more than covered by the extra return.

**By Science** Many of the new possibilities for higher production and higher profits have been created by the work of our scientists. For example, it was calculated, not so long ago, that the most profitable dressing of nitrogen, for winter wheat, was the equivalent of about 2 cwt. per acre sulphate of ammonia ; more than this was apt to cause lodging and so do

harm rather than good. But plant breeders have gone to work to produce shorter and stiffer-strawed varieties, and the most profitable dressing on average land and for the most suitable variety is now about 3 cwt. per acre. Again, the risk of wireworm attack, in wheat following grass, used to be a real deterrent to ley farming. Ten years ago the only help that the scientist could offer was to estimate the wireworm population of the soil and to advise about the prospects of a tolerable crop. Today, for the expenditure of a few shillings per acre on seed dressing, we can make sure of a crop. Again, infestation of corn crops with annual weeds was estimated, not many years back, to cost us a sack per acre—besides, of course, leaving a legacy of trouble. But our modern weed-killers are master of the charlock, the poppy and the starveacre. It took our forefathers a full century to raise the average yield of wheat from six sacks to eight. Ten years have sufficed to bring us from eight to ten. If all existing knowledge were to be fully applied, five years would carry us from ten to twelve.

As another example of the contribution of the scientist, let us think of the improvement in the health of our flocks. In 1879 three million sheep died of the rot ; some pastures, for lack of a few pennyworth of cobalt, were almost worthless for sheep ; everywhere during the summer months blow-fly was a constant anxiety to the shepherd ; the stomach worm turned thousands of strong lambs into miserable tegs ; vast numbers of thriving lambs succumbed to braxy or pulpy-kidney disease ; some hill grazings were abandoned because of tick-borne fever and louping ill. The outcome of research on all these troubles is that many more and much better sheep can now be produced with much less shepherding.

A catalogue of such advances would fill a book. On some farms all are being fully exploited. But if we could turn them to full use throughout the length and breadth of the country, we should be well on the way to the immediate objective of " sixty per cent plus".

**By Craftsmanship** It must, however, be said that the fuller application of science will not and indeed cannot be our sole guide along the road to the desired end. For one thing, success in farming is still largely a matter of craftsmanship. Skill in tillage is just as important in crop growing as the choice of the right variety or the use of the right fertilizer in the right amount. Again, a highly bred cow and a balanced ration are by no means a complete formula for profitable milk production—the practical skill of the cowman is still indispensible.

Moreover, the scientist does not profess to have all the answers and, where he fails, we must fall back on our farming lore. We seem to be in some danger of forgetting this. There is, for example, the matter of crop rotations. Under the extremity of war we were obliged often to depart from the sound rules of good husbandry—to follow wheat with wheat and more wheat, or to bring back potatoes to the same field more often than experience would have approved. In the short term these things were necessary. But we must now take the long view, thinking not only of this year and next but beyond ; we cannot mortgage the future for today. In particular, there is cause for alarm about the increase of soil-borne diseases and pests—Take-all and Eyespot of wheat, Potato Root eelworm and, lately, Cereal Root eelworm as well. It may be that science will one day provide the remedy for these troubles, and indeed it is already helping to mitigate them. But until we know better we must fall back on the knowledge that was gathered, the hard way, by our forebears.

Our modern fertilizers are in some measure a substitute for dung and other organics, but no reputable scientist would suggest that the latter can be dispensed with for long. Already there are indications that some of our light lands are deteriorating in structure for want of the yarded bullock or the folded sheep or of something that will do what they did to keep the land in good heart.

**By Reorganization** But a happy marriage between science and craftsmanship is not, by itself, enough. Farming is a business, and the whole organization of the farm must be kept under review in the light of technical progress and changing circumstances. In times past, when the rate of technical progress and of economic change was so much slower than it is today, a system of farming might persist unchanged for many decades. A set rotation could be followed, a more or less constant head of stock could be kept, and long experience had shown how many workers, how many horse teams and what tackle were needed to get through the work and keep up with the calendar. In many parts of the country the size of the farm was measured not by its acreage but by the number of horse teams needed to do the work, or the number of cows it could feed. Nowadays, the rapid stream of new knowledge and new resources, the changes in wages, labour supply and other economic circumstances necessitate the more frequent review of the farming system as a whole. It was easy to plan for stagnation ; it is difficult to plan for progress.

If a farm has been organized to be run with six men, how shall we make do with five ? If we mechanize the corn harvest and the beet lifting, and so save labour, how shall we do the beet singling ? Must we cut down the acreage of beet ? If we change from free-range grazing to strip-grazing, and thus make four acres of pasture do the work of five, what shall we do with the land that is to spare ? Increase the dairy herd ? Ensile the surplus grass and thus cut down the feedingstuffs bills ? Rear some beef stores or keep a flock of sheep ? Or shall we use the extra acres for cash crops and, if so, shall we need more labour and more machinery ? If we install a milking machine in a dairy of fifteen cows, and thus save half of a man's time, shall we start up a pig unit to make full-time employment for him ? What capital would this require ? Or, if labour is short, shall we look for ways of making do with a man less ?

Such problems, which used to face us only at long intervals, now come upon us thick and fast. The State has sometimes been blamed for aggravating the position by imposing "targets" for this or that crop, or by offering price incentives for this or that commodity, in order to satisfy the more clamant demands of consumers. But whatever the State may do, it cannot predict the changes in the farmers' circumstances that will arise out of the inventions and discoveries of science, and it cannot control economic forces in the world at large. It is thus vain to hope for a return to the slow rate of change of a hundred years ago.

It is not only farmers themselves who have been disconcerted by the need for frequent adaptations of their plans to the rapidly changing conditions of today. Our colleges and universities have continued too long the original emphasis on science and technology and are only now giving due attention to farm planning and farm management. As a consequence, it has been a common criticism of the Advisory Service that its younger members, while they can generally produce a sound prescription for a potato fertilizer, a dairy cow ration, or a grass seed mixture, are unable to look at the farm as a whole and suggest means whereby the available land, labour and capital

might be so used as to yield a better profit. During the past few years strenuous efforts have been made to meet this criticism, and considerable success can already be claimed.

Our country is not alone in its anxiety about future food supplies. Indeed, the whole world is short of food, and the shortage is increasing as the number of consumers grows. But there never was a time of greater progress in farming and never a time when new knowledge and new ideas were so freely shared. We have much to learn from other countries ; for example, the United States has long been short of manpower, and has much to teach us in the field of labour productivity ; Holland is very short of land, and has achieved a remarkable level of output per acre. But our own problem is different from either, for we are short both of acres and of men. We must therefore, in large measure, work out our own salvation.

## HOW EFFECTIVE IS FARM RADIO AS AN INFORMATION SERVICE ?

H. C. HUNT, N.D.A., N.D.D. (Hons.)
*Agricultural Liaison Officer*
*British Broadcasting Corporation*

Radio and television at the service of the farming communities of Europe was discussed at a three-day conference in London at the end of July.

I HAVE posed the question, but right away let me say there can be no straight answer ; for farm broadcasting varies the world over. In the United States, where I had the good fortune to study farm radio programmes extensively last winter, the service is comprehensive. In Great Britain and most other European countries the pattern is far more restricted.

Eleven countries and six international organizations were represented at the first conference on European farm radio, held by the F.A.O. in London on July 20–22, and for which the B.B.C. was privileged to act as host. Mr. John Green (B.B.C.), who laid the foundation of farm radio in Britain, was in the chair. The conference was planned on the lines of the Annual Conference of the National Association of Radio Farm Directors (N.A.R.F.D.) which meets each December in Chicago, and many problems confronting those responsible for agricultural broadcasting were discussed.

MR. R. HAKANSSON, Information Officer (Extension) F.A.O., Rome, the Conference Secretary, traced the organization, administration and control of radio in various countries and analysed the importance of radio as an informational and educational medium. Radio, he said, even if it reaches nearly every home, has not taken the place of newspapers, nor is it likely to replace reading as a means of acquiring knowledge. Nevertheless farm radio is an excellent mass medium, it is the cheapest means of communication in advisory work, and the potential audience in any area is large. But careful attention must be given to the way the information is put over—in the form of a straight talk or discussion, or in certain circumstances recorded by disc or tape machines on the farm itself.

Many European countries, realizing that farmers form the most isolated group in society, have from the beginning of their radio services given

agriculture considerably more programme time than any other group. Moreover, farm radio has been integrated as a part of the regular extension and advisory work.

The time devoted to farm radio services in European countries varies considerably. The following table prepared by F.A.O. gives a rough picture of the present situation :

**Time Devoted to Farm Radio**

| Country | Total Population (*millions*) | Agricultural Population (*percentage*) | Weekly Farm Radio Time (*minutes*) |
|---|---|---|---|
| Belgium | 8.5 | 18 | 30 |
| Denmark | 4.3 | 25 | 45 |
| France | 42.0 | 25 | 45 |
| Eire | 3.0 | 49 | 90 |
| Germany | 47.0 | 14 | 15-45 |
| Italy | 45.0 | 44 | 90 |
| Luxembourg | 300,000 | 17 | 30 |
| Netherlands | 10.0 | 12 | 75 |
| Norway | 3.2 | 29 | 30 |
| Sweden | 7.0 | 22 | 35 |
| Switzerland | 4.2 | 20 | 65 |
| U.K. | 44.0 | 6 | 25 |

Weather, rural market reports, gardening and home economic programmes and features are not included in the times shown in this table.

An extensive survey in the U.S.A. indicates that the best listening time is between 7 p.m. and 9 p.m.

Another American survey showed that people at the highest educational level read more but listen less to the radio than does the average person. The more intelligent and informed people also select their radio programmes with care, whereas the uninformed appear to leave the radio on for everything that comes along.

**Radio as a Medium for Information and Teaching** Considerable interest was evinced in the B.B.C's present serial programme " The Archers," a story of country folk. An article in the current issue of *The B.B.C. Quarterly* revealed that it was now the most consistently successful programme in the Light, with an audience approaching ten million nightly. As a means of fostering an interest in farming in the minds of the general public, many farmers consider it fulfils a need not met by the normal farm radio programmes. It also attracts the ear of the farmer's wife.

Several delegates made the point that radio often arouses an interest in the listener, which causes him to follow up for more detailed information from the press. The radio and the press are in fact complementary and should not be regarded as competitors. But as MR. D. HOCTOR of the Department of Agriculture, Dublin, pointed out, radio has its limitations ; it can supplement but never supplant a field advisory service. It can bring a wealth of general knowledge on farming to a vast audience in the minimum of time, but the local adviser is necessary to select, re-shape and adapt the knowledge to suit the particular circumstances of the individual farmer. There was, he thought, in most countries, a stratum of farmers who derived little benefit from the ordinary advisory service ; men who never attended meetings or demonstrations and seldom read agricultural literature. It is they who stand in most need of agricultural education and advice. The radio can be a potent instrument in awakening a first interest in progressive farming in such minds and in giving them an appetite for useful knowledge.

In his view, however, the formal lecture or talk is not usually the best technique to capture the interest of these farmers. What is wanted is a blend of farming information, news and entertainment. Similar views were expressed by the delegate from Italy, who said that most of the farming programmes in his country were of the feature type.

There was general agreement that the common aim among European radio farm directors was to secure more programme time on the air, better listening time and improved methods of presentation. Farmers in the main prefer listening to farmers, especially successful farmers ; but the number of speakers is limited. Farmers seem invariably to be shy of the microphone !

Mr. Wallace Kadderly, formerly in charge of the Farm Radio Service of the U.S. Department of Agriculture and now with Mutual Security Aid (M.S.A.), Paris, gave delegates the benefit of his long experience in training extension workers in America. He dealt with the preparation of scripts written for the spoken word and the relative merits of the straight talk, the interview, the discussion and the tape-recording machine.

My own investigations in the United States have shown that there is a much closer co-operation between local radio stations and the extension service (the counterpart of our own advisory service) than exists in Europe. But with 400 radio stations carrying regular farming programmes, and with many stations averaging around 20 hours time on the air each week, the position is hardly comparable with that in Europe.

Mr. Kadderley explained the set-up of the Information Division attached to many State land-grant colleges and universities. As a branch of the Extension Service, they supply day-by-day information to press, publications and radio, and in many cases they have built up extensive visual aid departments. Research and extension so often work side by side in each State, and this makes for a smooth flow of information. Moreover, several State colleges employ farm radio specialists who train the County Extension Agent in radio technique.

**Farm Television** The future of farm television in Europe was reviewed in the light of recent developments in the U.S.A. Mr. Layne Beaty, former Farm Radio and T.V. Director of Station WBAP, Fort Worth, Texas, and now with M.S.A. Paris, gave an interesting paper on farm television in the U.S.A., illustrating with a telefilm the one-hour programme given last December from the International Livestock Exposition, Chicago. This was carried on the coast-to-coast and T.V. network. It included remote (outside) television, studio production and commercial films.

Some 40 television stations in the States now carry regular farming programmes, the majority being daily during the dinner hour. Market reports and charts showing weather forecasts are being televised, and many programmes introduce extension workers and are highly instructive. Television sets in the States number 23½ million, with about 25 per cent in non-urban areas.

Mr. Godfrey Baseley of the B.B.C., well-known to many farmers in the Midlands, talked about farm television in Britain, where no regular farming programmes were at present included. But several outside broadcasts from both farms and agricultural shows have been televised. In the main, however, these programmes have not been of a specialist nature but designed for the general viewer. As television expands, he thought that agriculture and rural affairs would no doubt have wider recognition. A telefilm of a programme to schools from an Essex farm was shown which clearly indicated the immense possibilities of television as an instructional medium. At present, farm television in other European countries was confined largely to telefilm in schools on rural subjects.

The Conference left all of us connected with farm radio and television very conscious of the possibilities that lie ahead.

# SUCKLER HERDS IN NORTHUMBERLAND

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*County Agricultural Officer, Northumberland*

**Raising first-class beef stores by the suckler herd method demands careful management. It is, however, a system that is admirably suited to hill and marginal farming, and experience in Northumberland suggests that there is no better or more profitable way of getting good beef from such poor land.**

ALTHOUGH south-west Northumberland has a long cattle-rearing tradition and was, no doubt, producing beef when Hadrian built his wall, breeding has never been widely practised in other parts of the county ; farmers have relied very greatly upon Ireland for supplies of store cattle. Indeed, imports from that source have been running at over 60,000 a year. Recently, however, as a direct outcome of the scarcity and high price of store cattle, many shrewd men have turned their attention—at times rather reluctantly—to breeding. The result has been that the suckler herd in the county has increased by over 40 per cent since 1947, and today stands at 20,000 head.

With considerable areas of marginal and hill land, many extensive farms, and an exceedingly small labour force, Northumbrian conditions lend themselves more readily to the suckler herd system of cattle production than is perhaps the case in many other parts of Britain. Even so, such herds are by no means confined to the hill and purely marginal areas. They are, in fact, to be found in all districts from the traditional suckler herd country of the Roman Wall and the North Tyne, through the livestock rearing areas of the Wansbeck Valley and Coquetdale, to the large farms in the north of the county which have some livestock rearing land. Particularly is this the case where the rearing land is associated with good arable and grassland on the same holding. Indeed, suckler herds appear occasionally on good feeding land. Not unnaturally, there is often considerable debate as to the desirability of the latter practice. Few would deny that the maximum contribution that such land can make to the nation's food supply is by the fattening of older cattle, but, on the other hand, the suckler cow involves much less capital investment and she produces quality beef calves which command a ready sale.

From both the county and the national viewpoints undoubtedly the best place for the suckler herd is on the marginal land and, in some cases, the hill farm, particularly since it is from this kind of land that, with the encouragement of the Livestock Rearing Act, the most substantial increases in production are expected. As it is, rather less than one-third of the county's suckler herds run on land eligible for hill cattle subsidy, although this year the number of such cattle has increased by 500, or 10 per cent.

Whilst it is appreciated that it is to Britain's dairy cattle that we must look for the most significant contribution to increased beef supplies, there is nevertheless much scope for expanding the production of pure beef cattle. In the main, the extra output should come from the marginal land, and Northumbrian experience points to the fact that there is no better way of getting beef from poor land than through the agency of the suckler cow. At first sight, the one-cow-one-calf system appears to be rather extravagant, but as a method of obtaining beef from the hills it has no equal. Suckler herds provide the market with first-class beef calves which have had that all-important advantage—a really good start in life. Such cattle are worth infinitely more, as indeed the current sale prices show, than indifferently

bred animals which have been " dragged up," or, to put it in more "parliamentary" language, reared on a lower plane of nutrition. Such animals add to the count but seldom to the efficiency of production. The fact is that the nurse cow can thrive under conditions where it would be most difficult and, at all events, very expensive to provide young stock with that reasonably high plane of nutrition in their early lives. How often have the hills—perhaps sometimes rather unkindly—been associated with the growth in young cattle of little else but hair !

Although suckler herds make less intensive demands on management than most stock enterprises, there are certain essentials necessary for success. Some of the main requirements, based on Northumberland experience, are discussed below.

**The Right Parents** The first step to success in running a suckler herd is to start with the right type of cow, suited to the land and capable of withstanding the climate. The suckler cow should be as good an example of her breed or cross as it is possible to obtain—a deep-bodied, blocky animal, hardy, a good milker, and docile. As William Youatt put it, writing in 1846, " docility of disposition is an object of great moment," and in the delightfully dogmatic style of the agricultural scribes of the times he goes on to say : " it is an indisputable fact that tame beasts require less food to rear, support and fatten them"([1]).

Irish Angus × Shorthorn cows form the basis of many herds on much of the better land. These cattle are hardy, docile, easy to keep, reasonably good milkers, pass the tuberculin test well, and are naturally polled—all very desirable features in suckler cows. Irish Hereford cows with perhaps a little Shorthorn in them are also quite widely favoured. They may take a little more keep than the Angus, and may not match up to the latter in quality, but they are thrifty and produce early-maturing, sizable and beefy calves. English Herefords and Shorthorns and their crosses are also quite numerous, whilst the Galloway and the Highland crosses hold pride of place under the hardest conditions. The hardy Galloway cow, with her double coat and her ability to forage and live under difficult conditions, her true beef qualities and, not least, her long life, is a firm favourite with many breeders on the hills, especially in the wetter south-west. Her progeny from the white Shorthorn bull, that is, the "blue-grey," is much sought after, both for feeding and breeding. Although slower maturing, these cattle can make good growth under good conditions, as was shown by one of such breeding which was graded at Alnwick last January as a " super-special" at 12¾ cwt., being less than three years old and having been fed entirely on home-grown foods.

The Highland cow is occasionally seen in Northumberland, and local experience here bears out the contentions of some Scottish breeders that the Highland cow, crossed with the beef Shorthorn, produces just as good a hill cow as the pure Highland, and at the same time gives earlier-maturing, bigger calves. Indeed, one of the county's best known herds has gone a step further and, due to a long and successful programme of land improvement, now carries twice crossed Highland cows which produce, with an Angus bull, calves that make heavy demands on the prizes at the local suckler sales.

Northumbrian breeders believe that if the suckler-herd system of beef production is to succeed the aim must be to produce the best calves that the land will allow, and to this end the finest pure-bred bulls must be used. A good crossing bull must be a first-class example of the breed, although it will be appreciated that in some breeds crossing requirements do not always

match up with export demand. For home use, size as well as quality is required. For the production of blue-greys, some breeders, especially those producing heifers for breeding, like a white Cumberland Shorthorn bull rather than the Scottish pure beef Shorthorn, since the Cumberland bull probably transmits more milk.

As Dinsdale and Tansey point out in their report on the costs and returns from beef cattle reared from suckler herds ([2]), the three items which, from the management standpoint, have the strongest effect on net results are : (1) herd maintenance ; (2) feeding ; and (3) the calving percentage. Experiences in Northumberland are, therefore, discussed under these headings.

**Herd Maintenance** Except on Galloway farms, herds are maintained by buying in heifers. The price of such animals has a marked effect on herd maintenance costs and is largely outside the control of the farmer. Normally, rather more heifers are bought in than will be required to provide replacements. This enables a certain amount of culling to take place, although all the bought-in heifers are normally put to the bull. One or two extra quality calves, which are normally required in the large herd, and which are otherwise difficult and expensive to come by, are thereby provided. In at least one herd the practice is to buy in rather younger heifers and to put to the bull only those which have shown an ability to thrive under outside wintering conditions.

The average productive life of the cows in the suckler herds appears to be about 8 years, although in the Galloway herds, where it is the normal practice to allow the cow to run barren at least once during her productive life, there are many matrons of 14 or more years.

Some breeders tend to think in terms of age groups, and several believe that probably the most satisfactory system would be to draft the cows more or less like the hill ewes. If there were a trade for such cows to go on to rather better land, no doubt there would then be much to commend the system, but as yet no such trade exists. Others take the view that cows should be worn as long as possible, and, certainly, herds with a high percentage of old cows will thus keep their maintenance cost at a reasonable level, although it could well be argued that the old cows take much more feeding, which means greater expense.

The bull is a significant item in herd maintenance, especially in the smaller herds. The average life of bulls in suckler herds appears to be in the region of 8 years, and generally no particular difficulties are experienced in management. Almost everywhere the bulls are kept outside and so wintered cheaply. This involves putting them in a well-fenced field near to the steading, preferably where they have some outside shelter. Frequently, several bulls run together during the winter and, whilst they may fight a little at first, they soon settle down and live peacefully together. Under such natural conditions, bulls keep healthy and active and remain good on their feet. Young bulls which have been brought up expensively for sale have to be rather carefully managed for the first winter until they have become hardened to more natural conditions. About 20 cows are given to young bulls, whilst the mature bull generally caters for 40. Any attempt to cut down on the maintenance costs by using an inferior bull would be regarded as false economy for, as has already been stressed, the success of the suckler herd system depends very much upon breeding quality beef cattle. Nature provides good feeding for the calf, and it is up to the management to provide the best breeding.

**Feeding** Sound farming, involving adequate use of lime and phosphates, lays the foundation for the well-being of the suckler herd. The cost of feeding is shown by Dinsdale and Tansey to be by far the most expensive single item of management. Foods, apart from grazing, accounted in 1950–51 for £7 12s. of a total herd cost per cow of £18 12s. Breeders are very much alive to this fact, especially on the marginal and hill farms. Indeed, the new Hill Cattle Subsidy of £10 per head on breeding cows and in-calf heifers is, in part, designed to finance the provision of fodder. In the "land of Goshen" much has been heard in recent years about extending the grazing season and providing grass for cattle to eat *in situ* all the year round. Such a system is not new in the hills, and, indeed, it forms one of the basic principles of suckler herd management on many farms. Adequate roughage, or should we say grass, is allowed to accumulate for winter keep, and, weather permitting, it enables the cows to fend for themselves until Christmas or perhaps New Year. After this, a supply of roughage encourages the cow to forage for herself—an important aspect of management. In this way the costs of feeding are often kept at a reasonable level. But it is not always as easy as it looks, since when farms are improved the tendency is for them to become more heavily stocked and more intensively grazed. On such farms it may well be that winter accommodation is adequate and, in that case, considerable advantage will be gained by wintering cows inside, especially to provide farmyard manure.

Feeding practices differ throughout the county. The suckler herds on the large arable farms get a varied diet—straw, hay, silage, swedes and perhaps some home-grown corn—but the herds on the purely marginal or hill farms have in the main to manage on hay alone, although some have silage and, in exceptional circumstances, a little bought concentrates. The part played by good hay in bringing the cows to calving in fit condition is, however, widely appreciated. The addition of green material or silage has also been found by many breeders to be most beneficial, and there are a number of large herds which are wintered almost entirely on grass silage. It is generally appreciated that mineral feeding is most beneficial to the health of the herd and, in practice, appears to be a cheap and effective way of keeping such troubles as staggers and other similar metabolic disorders in check. Minerals are provided in a variety of ways—from troughs, as licks nailed to posts, sprinkled on the silage, or supplied with the concentrates.

The normal suckler cow receives daily about 15 lb. of hay or its equivalent and is fed once a day in the early morning, except in very bad weather, when two feeds will be necessary. The good hill cow receiving such a ration still has the urge to fend for herself and to forage, which, as has already been said, is an important aspect of management. If the outwintered cow is heavily foddered she gets into the habit of standing about the gateways and does not winter nearly so well as the active cow who spends much of her time foraging. The value of natural shelter and a dry lie on farms carrying outwintered suckler herds cannot be over-emphasized. They help considerably to reduce the cost of the winter feed and contribute a great deal to the well-being of outwintered cattle.

**The Calving Percentage** Obviously an essential feature of the suckler herd system is that each cow suckles a calf every year of her productive life. In practice, with well-managed herds on the better land, the calving percentage runs out at 95 per cent or more, whilst in the Galloway herds and those running under the hardest conditions, the percentage is down to 85 per cent or less.

The suckler herd system is as near to nature as any form of cattle production and, therefore, it is not surprising to see the comment by Mr. Lyle Stewart([3]) that " hill cows were reported to be exceedingly healthy and free from infective diseases such as tuberculosis, abortion and mastitis". The same writer also draws attention to the consistently poor breeding records of many hill herds. Plainly, management must be designed to maintain the fertility of the herd, and experience shows that fertility in suckler herds is very markedly dependent upon feeding. If cows are to breed regularly and at the right time, they must be in a satisfactory bodily condition. If they are not, nature ordains that their reproductive functions must cease temporarily. Unlike the hill ewe, which comes to the tup at the time of year when she is in the peak of condition, the suckler cow is served when she is likely to be in the lowest state. Therefore, if a satisfactory calving percentage is to be obtained, the herd must not be allowed to get too lean after calving.

Herds on good lowland farms usually start calving in early January and February for, if the system is to pay under these better conditions, the highest possible price must be obtained for the suckler calf, which must be born early and have the opportunity to make maximum growth before sale in October. Under hill conditions, on the other hand, the cows generally start calving about the beginning of March, the heifers normally calving about a month later than the cows. A cow can produce sufficient milk for the young calf, although she may only be getting hay and perhaps some silage, whereas the heifer is rather more dependent for an adequate milk flow on getting a supply of grass. The ideal is so to time the calvings that the milk production of the cow coincides with the calf's capacity to deal with it. With early calvings on good farms, the fit condition of the cows may sometimes be rather embarrassing, since they may have more milk than the calves require, at least during the first week or two of their lives. Occasionally, such cows are milked. Indeed, it is the general practice in the west of the county, where the cows are often housed, to take the surplus milk from them for a week or two until they are turned out permanently with their calves. In some lowland herds, scour amongst calves is sometimes troublesome even with outside calving. It may well be of nutritional origin associated with a surplus of milk in the early life of a calf. On the hills, most people like to get the calving well advanced before lambing begins, thereby spreading the labour load at this busy time of year.

Some Galloway herds which are wintered inside calve in autumn so that their young get the benefit of both autumn and spring flushings of milk, and some breeders maintain that with this system the cows breed more regularly. Occasionally, on some of the hardest farms, bulls run permanently with the cows.

Losses of calves are not frequent, for nature provides in an uncanny way for the very young. The majority of the herds calve outside and the hill cow knows her ground just like the hill ewe, and, even under the wildest conditions, seems to be able to find a little sheltered spot in which to calve. It is surprising how a few rushes or a bit of rough growth will provide shelter for the young calf. White scour is sometimes troublesome, especially when the herds are wintered inside, and on some lowland farms it has become necessary always to calve the herd outside. Occasionally calves become infested with stomach worms, but dosing with phenothiazin gives a good measure of control. Now and again losses occur at a later stage : in one case it was found that strong calves were picking up dead herbage which

caused trouble, and calves, like lambs, can pick up wool—with the same disastrous results.

The bull is an important factor affecting the calving percentage, although careful note will always be made to see if the cows are returning to him. It is generally found that if a cow does not calve before the end of June it is liable to be barren the following year. It is also our experience in Northumberland that the bulls are more likely to become sterile if kept on tick-infested land.

There are many other items of management, for example, good herding, which affect success. Thus dogs should not normally be used amongst suckler cows. Anything which can be done to keep the herd docile and quiet is worth while. Many owners in Northumberland, by taking advantage of the fact that the natural conditions under which the cows are kept lend themselves more readily to attestation, are increasing their income in this way. Such a simple and practical measure as dehorning the cows makes them more docile and easier to feed. Timely weaning of the calves is also important. In all well-managed herds, on anything but the very hardest land, the calves will be weaned in October or early November. The nurse cows then have an opportunity to gain condition before the onset of winter or, on the best farms, before calving again.

**Integration with the Lowland Farm** It is appreciated that these observations deal only with the production of quality beef calves from suckler herds. The great question of how these calves are to be catered for after weaning and until they are ready for the feeder has not been discussed. It is not unreasonable to hope, however, that ways and means can be found whereby the handling of good-quality beef calves can be fitted profitably into our farming systems. As a land improver under marginal and sometimes hill conditions, and as a producer of potential beef from these areas, the suckler cow has no equal. Would it be too old-fashioned to suggest that her progeny may also have a contribution to make to the well-being of the lowlands ? For before being fattened on the grass the calf can profitably deal with much straw, most of which will be trampled into muck—that which is still worthy of its old designation, "the mother of money ".

So urgent is the need to expand home meat production that public funds are being made available through the agency of the new £10 Breeding Cow Subsidy and the Calf Subsidy Scheme to encourage the expansion of beef production through the breeding and rearing of many more suitable calves. No method of cattle production can compare with the suckler herd system in supplying the type of animal which will grow into not only the most efficient beef producer, but also the provider of that first-quality meat which will give such satisfaction to the consumer.

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# WIND EROSION AND THE VALUE OF SHELTER-BELTS

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How can we best protect the fens and sandy soils of East Anglia against wind erosion ? Are shelter-belts a practical or economic solution ? The arguments for and against the various methods so far tried are broadly reviewed here by Mr. Sneesby.

WIND erosion of soils occurs in varying degree in all parts of the world. In some countries—notably the United States, Canada, the Soviet Union, China and Australia—vast tracts of prairie or steppe-land suffer every year from the ravages of the strong winds which sweep unhindered across these wide spaces, and the damaging effects on agriculture have long been recognized as a national problem of high priority. In others, of which our own is one, soil blowing may be regarded as a local problem ; relatively few farms are affected and there is an understandable tendency outside the vulnerable areas to minimize the significance of wind erosion as a factor affecting food production. When it is considered, however, that some of the districts subject to "blowing" in Britain are capable of the most intensive cultivation with market-garden crops, it becomes clear that such soils cannot be left at the mercy of the wind indefinitely ; not only do the crops suffer, but the finer and more valuable constituents of the soil itself are also carried away, so that the land is bound to become less and less naturally fertile with the succeeding years.

Anyone who has witnessed a "blow" in the black fenland of the Isle of Ely, the sandy skirtland of West Suffolk, or the Breckland sands around Thetford and Brandon, cannot easily forget the awe-inspiring sight of many tons of black dust or tiny sand grains being borne in vast clouds reaching several hundred feet in height and reducing visibility to a few yards. It takes months to rid fenland houses of the dust that penetrates through cracks, under doors and round window frames, and insinuates itself into every nook and cranny. Needless to say, farm work during a "blow" is both useless and impossible, and the farmer has no choice but to take shelter and watch despairingly the loss in a few minutes of an entire crop of sugar beet. Spring-drilled seed will be blown away with soil and fertilizers to fill the fenland dykes—choking drainage and making their clearance an immediate necessity—or to pile up under Breckland hedges, where the sand-drifts provide a paradise for the rabbits which rival the wind as the curse of this region. Potato ridges are flattened, while young plants may be torn bodily from the soft peat or loose sand, or cut and bruised by the flying grains so that they are easily injured by frost ; even autumn-drilled corn is not immune. It is small wonder that farmers have thought long and hard for remedies and that so many original ideas have been tried, many of them to be discarded but others to provide valuable additions to the fund of practical knowledge that is waiting to be tapped and made generally available to all who suffer this hardship.

**Causes of Soil Blowing** Before the farmer can begin to consider remedies he must know why soil is blowing on his land. He may, in fact, never really understand why one field "blows" while the soil of the next, outwardly similar, is virtually unaffected ; such happenings are bound up with differences of soil composition and texture, and these become

evident only under examination by the scientist. Long experience alone will tell the farmer on which fields to direct his attention, and no amount of external advice can compensate for this.

There are, nevertheless, a number of general factors which are recognized by agricultural opinion as giving rise to the conditions necessary for a "blow". The coming of fenland wind erosion on a large scale coincided with the increased use of sugar beet and other roots in the rotation during the early 1930s. The soil, harrowed and rolled to a fine preparatory seedbed in early spring, does not require an especially strong wind to set the surface dust moving. An experienced farmer will avoid treading on land prepared for roots, as soil blowing can start on a tiny piece of particularly dusty land, from which it will spread rapidly over the whole field. Once raised, a whirl of dust tends to exert a pull upon the land surface, and the effect is cumulative, so that one can see spiralling clouds of fine soil travelling in ever-increasing size across the field.

A large number of farmers will maintain that the gustiness of the wind is more significant than the strength, the gusts exerting different pressures over the field and thus setting up minor whirlwinds into which the dust is drawn. Thus a 15–20 m.p.h. gusty breeze may set up soil blowing more readily than a steady wind of 25 m.p.h. Such farmers will be careful to avoid planting tree-belts in which the individual trees are too widely spaced, using the wrong kind of tree and so letting a wind current through near the ground, or making access gaps in the belt too narrow, thereby causing draughts to blow through these gaps.

The two main conditions leading to soil drifting would thus appear to be (1) an open, or virtually open, land surface, where the soil has been broken down by frost and cultivation into a fine tilth and whose surface has dried out to form a dust, and (2) a gusty wind.

**Adjustment of Sowing Dates to Avoid the Danger Period**

Knowing these conditions, the farmer has two choices before him : he may accept soil blowing as inevitable but try to lessen the injury to his crops, or he may attempt to control it. Some farmers take the view that, despite the losses involved in a "blow," the occurrence is not frequent or regular enough to warrant any positive action other than to take commonsense measures to reduce the damage as far as possible. This attitude is found most frequently in the fens where the soil is more fertile and a redrilled or a catch crop may still be profitable in spite of the reduced yield ; it is less common on the poor Breckland sands where late germination is a hazard and the resultant crop may hardly be worth taking.

Farmers of this opinion rely upon adapting sowing-time to the "blowing season," drilling their seed only at the beginning or end of the danger period, when soil blowing is least likely and inclined to be least severe. Records of dust-storms sighted at the weather station at Mildenhall in West Suffolk between 1935 and 1953 show that in this district soil blowing has taken place predominantly in late March and in April ; fifteen out of the sixteen instances occurred during this period, when strong winds and warm sun have dried out the surface after the damp of winter. Severe wind erosion in other months cannot, however, be ruled out. Thus the remaining Mildenhall record relates to a dust-storm on February 27, while a farmer in Mildenhall Fen told an investigator of a "blow"—doubtless too local to be officially recorded—which took place in June 1944, during which a 15-acre crop of sugar beet was so badly damaged as to be written off as worthless.

Nevertheless, such cases are unusual, and the systems of early and late drilling are based on the assumption that soil blowing is only likely to take place between the middle of March and the end of April. If drilled in late February, sugar beet should, the argument runs, be sufficiently developed by March and April to withstand the buffeting of wind and blown dust. In practice, this is usually not the case, and this measure finds very little favour. The plants are susceptible to damage for several weeks after germination, since they make very slow growth during this cold period and are still likely to be vulnerable to injury by mid-March, when the night frosts will quickly finish off the work of the wind.

After April the increasing cover provided by growing crops, grass and hedgerow foliage makes the blowing of fields less likely and the chances of survival of a late-drilled crop are consequently greater. There are, however, two arguments against delaying seed drilling. In the first place, the possibility of out-of-season "freak" winds cannot be ruled out, and, secondly, yields are likely to be adversely affected by the drier weather of late spring (especially in the Breckland) and the shorter growing season.

During an inquiry into wind erosion in the eastern counties carried out by the Agricultural Land Service in 1951, farmers were asked to say from their own experience which period they regarded as best for sugar beet drilling, taking all these factors into account. Generally, they favoured the first fortnight of April in the Breckland and the first week in May in the damper and more fertile fens.

**A Cover Crop the Best Answer** While most farmers have an eye to the best time of drilling to avoid loss by wind action, an increasing number are not satisfied that this form of safeguard is reliable, and have evolved positive measures. Three ways of dealing with the problem are open to them. The perfect answer is, of course, to cover the field surface with crops or grass during the danger period. If this is impracticable, an open piece of land can be made less liable to blowing by treatment of several kinds. Finally, either as an alternative or in conjunction with this last measure, an attempt can be made to get to the heart of the problem and to find some way of reducing the wind strength as it passes over the land.

The only way of covering fields effectively for a period of years is by putting them under grass. On the poor soils of the Breckland leys already form part of the rotation on the great majority of farms. This system would undoubtedly be practised in Breckland in any event since it has become clear through the work of Lord Iveagh that herein lies the best future of this naturally infertile part of East Anglia. Nevertheless, farmers are tending to plan their cropping so that the fields most vulnerable to the wind—whether by aspect or soil composition—are kept under grass for as long as possible. When ploughed, however, the soil may have been so broken up by the fibres of a long ley that the field will react in a similar way to reclaimed heathland, on which sand drifting is frequently severe for the first few years. Thus this system cannot be looked upon as providing a permanent cure. On the black fens there is traditionally little or no ley farming, and farmers are slow to turn to a different form of husbandry. Though they undoubtedly accept the view that the amount of fenland blowing would be much reduced by the use of grass they would not, in general, regard this as sufficient compensation for the many difficulties and expense involved in the change-over. Furthermore, short-term leys would be the order on this type of land, so that the length of protection would be less. For these reasons, leys are unlikely to be used to any great extent as an answer to soil blowing in the fens.

**Methods of Binding the Soil** Apart from the obvious negative step of keeping the roller off a field when gales are forecast, a number of measures can be adopted for the purpose of roughening a bare land surface or strengthening or binding the soil. These include the late use of the plough, with a consequential reduction in the period of frost action, light harrowing when soil blowing appears imminent, deep ploughing where the subsoil is clay or marl, the use of short farmyard or green manure on land where these can decompose rapidly, "salting" the surface (though a normal dressing of fertilizers has a very limited binding effect), and the use of lime, which, however, is resistant to the wind only before it is crumbled down. It is also suggested occasionally that some form of spraying of the soil surface might be evolved.

There is only one really satisfactory way, however, of freeing land which has to be open in spring from the risk of erosion over a succession of seasons, and that is by spreading clay or marl. Nearly all Breckland fields possess at least one derelict, and usually overgrown, pit as evidence of the once widespread practice of applying the chalky marl by hand. While local opinion is strongly in favour of the reintroduction of this practice, it is difficult to see how it could be made an economic proposition in the Breck country today, particularly as spreading would have to be carried out at fairly frequent intervals to counteract the rapid leaching and downwash of the finer soils in this region. In the fens, on the other hand, a clayed field may not blow for fifty or sixty years, and claying is regarded with something akin to reverence by the fenmen. Clay not only binds the soil but gives it "body" and reduces the rapid wasting of the organic material which gives the fens their fertility. In most cases, however, the clay is too deep to be reached by the plough, and hand-spreading from trenches—the old method of claying—is now out of the question for the unaided, small-scale farmer because of the expense and shortage of labour. The alternatives are to extract and spread the clay mechanically, or to transport it by lorry from distant clay pits. Only the larger farmers can normally afford these methods. Two other suggestions occasionally made are the transport of crushed clay in bags to the affected fields, or the extraction of material from the silt roddens which represent the courses of former rivers and which are now raised above the adjacent shrunken peat.

**Windbreaks** There is one other answer to the problem of the wind—that is to try to reduce its force over the areas where it is likely to cause damage. This can be done by the creation of something which will either exert a drag on the wind at ground level or deflect the airstream so that land on the leeward side of the barrier becomes reasonably free from the risk of soil blowing.

When referring to agricultural windbreaks one is automatically inclined to talk in terms of tree-belts or high hedges. The very considerable controversy surrounding the value of this form of windbreak tends to draw attention from the importance of such measures as the building of low earth barriers to prevent dykes from being filled with blown soil. Two-foot banks—easily constructed from material thrown up in ditching—may give protection up to twenty yards, and have been found to be highly effective in keeping the ditches clear. On the field itself, a few farmers practise a system of "ridge-and-furrow" cultivation, the seed being drilled protectively in the furrows. This, however, is of proved value only against light winds. Singled sugar beet and hoed weeds are also left lying between the rows, and no doubt this helps to reduce the wind strength a little.

Within the category of windbreaks come two similar measures which have proved successful enough to warrant further practical experiment in their use. Both are based on the system of strip-cropping. The first, and much more prevalent, method is to use winter corn, kale or temporary grass as wind-resistant strips varying in width according to field aspect and slope, amount and type of other shelter, and strength of soil ; they may be anything from 50 to 200 yards wide, tending to be wider on the larger and less productive Breckland fields. These crops are alternated with one or more strips of roots or other spring crops. Thus sugar beet, which is highly vulnerable, might be drilled to a width of 50–100 yards directly to lee of the "guardian" strip, with a similar width of a more resistant crop, like potatoes, beyond that ; and this layout would be repeated over the whole field. It is not claimed that such a system offers complete protection. The distance of full shelter has been estimated as up to 70 yards when a corn crop is about 1 foot high ; beyond this, some soil blowing may occur, but it is unlikely to have a serious effect before the next resistant strip is reached. This method of protection is thus bound to prevent the accumulation of soil blowing; as the farmer says, it stops a field from "sweeping". There is doubtless a future for it, particularly in the fens.

The other system is to drill narrow lines of corn—usually quick-growing rye—in a field of roots. Although it is claimed that strips 3–5 feet wide will shelter up to three chains, this measure has been put into operation on only a few holdings. It is considered not only rather uneconomical—the corn is not harvested but regarded as expendable in the cause of protection from the wind, which may not produce any soil blowing in some seasons—but also a trifle impracticable in this form. The same arguments apply to the suggestions of drilling one row of corn to two of sugar beet, or introducing lines of corn at right angles to the sugar beet rows. Nevertheless, there may be room for developments on such a basis ; farmers have, of necessity, to be resourceful, and new ideas are continually being tried out. The drawback of the strip-cropping system is that it relies upon the wind blowing more or less across the resistant strips ; clearly if it blows along them there is no protection at all. Wind direction is similarly a most important factor when shelter-belts come to be considered.

The 1935–53 Mildenhall statistics previously referred to include information on wind direction when dust-storms were recorded. On two consecutive dates the wind came from between E by N and ENE, and on another date from the NE, the soil blowing in each case being of average severity. On two further occasions the wind was north-westerly and at one other period it blew from the SSW : on the remaining ten the direction varied between south-west and west. There was no apparent connection between wind direction and strength during these blowing periods.

These statistics tend to confirm the general experience of farmers, and the evidence of leaning trees and hedges, that most of the damaging winds come from between south and west, the latter direction being predominant. Action taken against these winds would no doubt have effect on all but a few "blows," but to be quite certain of eliminating all danger of soil erosion on a particular field any system of windbreaks would have to take into account the possibility of winds from other directions. These winds may be exceptionally severe ; on a farm in Mildenhall Fen one of the worst "blows" ever experienced was caused by a wind which came from due north!

**The Shelter-Belt Controversy** Of all the ways of safeguarding land and crops from the ravages of the wind, none is so much the subject of argument in the affected areas as the use of shelter-belts. Are they on balance beneficial or harmful to agriculture in the different soil-blowing districts ?

The term "shelter-belts" strictly means lines or plantations of trees planted primarily for their value as windbreaks, but it is sometimes—as here—widened to include farm hedges. Many who find strong arguments against tree-belts regard hedges as valuable allies in the fight against wind erosion ; this is especially noticeable in the fen country, where only a tiny proportion of the farming population would give their full approval to tree planting, though the value of hedges is generally appreciated. In the sandy Breckland, on the other hand, the use of trees finds much more support, while hedges are frequently whole-heartedly condemned. While it is true that tradition has its part in the formation of prejudice in the case of tree protection—the Breckland has had tree-belts for over a hundred years, whereas in the black fenland any tree is at a premium—this is only a minor factor in the controversy. The reasons for the different views on both tree and hedge shelter are born in the main from long experience of individual members of the farming community.

Before the opposing viewpoints can be studied, a distinction must be drawn between good and bad windbreaks ; naturally a farmer whose land is sheltered only by the latter type may well have his opinions clouded by his own unfortunate experiences.

An efficient shelter-belt should be thick enough to absorb the force of the wind but not so dense as to present an impenetrable barrier. This is because a region of reduced pressure may be set up behind an excessively dense windbreak, and the air current is likely to be drawn rapidly downwards into this low pressure "pocket," so causing soil blowing to begin nearer the windbreak than would otherwise have been the case. Tree-belts vary very greatly in density, this being dependent not only upon their width but upon the type of tree grown (deciduous trees are not of much value as shelter in early spring), closeness of planting and amount of undergrowth. Thus one cannot generalize on the best width for a tree shelter-belt, but from evidence obtained in the Breckland during the inquiry previously referred to, it appears that the distance sheltered is likely to decrease markedly with belts of less than 30 yards wide, a hedge of average thickness being much more efficient in proportion to its height. Closer planting might, of course, mean that a narrower belt could still be reasonably effective, but the difficulty is that close-growing trees will lack light and will tend to grow upwards, so that lateral branching will be poor and the only effect upon the wind will be the creation of gusts by the tree trunks. Anything producing draughts should be avoided as far as possible. It is, of course, necessary to have some gaps in a belt for tractor access, and so on, but it may be that a wider break, by reducing the draught effect, causes less damage than a narrow one, to leeward of which severe blowing occurs as the wind rushes through the gap.

Needless to say, to prevent draughts and gusts a belt should be uniformly thick ; the ragged lines or narrow belts of Scots Pine so frequently seen in the Breckland are of no value whatever, and give shelter-belts a bad reputation which they do not necessarily deserve. It is very desirable to choose trees that will make good growth laterally and not lose their lower branches with age—as does the Scots Pine—and to encourage this lateral spreading by cutting back the heads ; to do this, however, requires a certain amount of space for individual trees, and to achieve the best thickness it may be

necessary to plant a fairly wide belt. There is thus a very strong argument, so far as saving land is concerned, in favour of good, high hedges instead of tree-belts, though—as will appear later—there are other factors to be taken into consideration. The point made here is that the value of shelter-belts should be judged in terms of belts which efficiently fulfil their shelter function.

**Effective Shelter Area of Windbreaks** Over what distance would such a windbreak be effective? The area sheltered would be affected by what might be termed the "setting" of the windbreak—aspect of the land, steepness of slope, kind of soil and drainage conditions—and by the amount and type of windward shelter, which may reduce the wind strength to some extent before the windbreak itself is reached. Bearing this in mind, it should be possible, by reference to the known protective influence of an adequate sample of wind barriers, to arrive at a rough "rule of thumb" to be used by a farmer when considering the pros and cons of shelter-belt planting; anything more definite is out of the question because of these variable factors whose relative influence cannot be accurately assessed. In the A.L.S. investigation into soil erosion special attention was paid to tree, hedge and other shelter; over fifty examples of windbreaks in varying settings were carefully inspected, and information on their shelter value, together with many other useful observations, was supplied by the occupiers of the farms affected by blowing. These were situated within the "catchment areas" of the Ely and Bury St. Edmunds beet sugar factories and so were representative of peat, sand and "Breck-fen" soils. The inquiry was an exploratory one, and the farms visited were limited to those where the farmer had reported a crop loss to the factories in the spring gales of 1950—a bad year for blowing—so that the findings must be regarded rather as a basis for further field work than as an exhaustive analysis of the subject. The following is a brief summary of the results as regards shelter value:

1. Nine of the twenty-seven tree-belts inspected consisted of thin, ragged rows of no windbreak value whatever; of the remaining eighteen, the maximum distance sheltered was 27 times the height of the belt, and the average shelter-height ratio was 14.

2. The maximum shelter distance reported was 300 yards. This was afforded by two mixed plantations, the first 30–40 feet high and 220 yards wide, and the second 50–60 feet high and 250 yards wide; in the latter case the land sloped steeply away from the damaging wind.

3. The maximum shelter-height ratio of eight thick hedges between 8 and 20 feet high was 45 (180 yards) where a hedge formed part of a network of windbreaks, and 30 in the case of individual hedges; the average ratio was 27. A number of poor hedges gave negligible shelter.

4. The maximum shelter-height ratio of four solid windbreaks of similar height to the hedges was 20, and the mean was 17. Earthen banks some 2 feet high were, however, reported to shelter as much as 30 times their height.

In terms of efficiency, height for height, hedges would appear from this evidence to be better than either tree-belts or solid windbreaks, such as river embankments. This assessment may, however, be regarded by the supporter of tree-belts as a little academic. He is mainly interested in actual distance sheltered and would stress the fact that a 20-foot hedge sheltering 27 times its height protects 180 yards, whereas a 50-foot belt of trees with an efficiency ratio of only 14 would nevertheless shelter over 230 yards, and would thus be of more practical value. This is where other factors enter the argument

Does the additional 50 yards of shelter compensate for the extra amount of land taken up—which may be a strip 50 yards wide—the increased amount of shade given by the higher windbreak, the more extensive root spread, and so on ? And—most fundamental of all—assuming 300 yards to be the maximum protective influence, are windbreaks worth while at all ?

**Are Windbreaks Worth While ?** In practice, the only real arguments in favour of shelter-belts in this country are that they protect arable land, crops and spring pasture, and give shelter to animals. In other countries they have considerable snow-break value, but this hardly applies here, while the argument that they provide timber is not put forward with much conviction; usually, when a belt is dismembered for this purpose its shelter value drops, and in any case the type of growth required for timber is not that which is best for shelter purposes. With wide belts a certain amount of thinning might safely be carried out, but the question of land use would then enter into the controversy; the wider the belt the more land withdrawn from farming use.

This land use argument is put forward very strongly by the opponents of shelter-belts. If a 30-yard belt could be grown thick enough to shelter 300 yards—and this is rather doubtful in the light of the evidence obtained—the protection of a 100-acre farm from the south-west winds only would mean parallel belts at 300-yard intervals with a loss of about 9 acres of cropping land. Provision of complete shelter from every direction would entail planting nearly one-fifth of the farm with trees. No fenland farmer would countenance the permanent loss of returns on this amount of land for the sake of preserving his roots from blowing once in, say, every three years, while, looked at from the national point of view of food production, there can be little said in favour of such a system.

In the Breckland, 30-yard belts may be more of an economical proposition on account of the poor land quality, which means that the farmer is financially harder hit by blowing than his fenland counterpart. However, the Breckland fields are much larger, and considerable subdivision and alteration of shape would have to be carried out ; this would interfere with the large-scale mechanized operations which help to make farming in this area economically worth while. Narrower belts, sheltering say 150–200 yards, would mean further splitting up of fields into parcels not exceeding 8 acres in extent. As an overall policy, then, the planting of shelter-belts, either in parallel lines or fully enclosing fields, appears impracticable, but there are many patches of very poor agricultural land where judicious siting and alignment of the right type of tree-belt might be very valuable, especially if used in combination with other measures, in helping to prevent soil blowing on particular fields. But on the fens such patches are so few that good agricultural land is almost bound to be taken up in any shelter-belt planting scheme. Hence, in this region, those supporting windbreak planting almost all prefer hedges to trees.

**Hedges or Trees ?** Fenland hedges are not often seen, but a number of farmers have given some thought to this form of shelter. Of thirteen farmers visited during the inquiry, seven spoke in favour of large-scale planting of hedges, and only four were definitely against it; on the other hand, only one supported tree planting. Hedges would admittedly take up cropping land, and this loss would be augmented by the loss of production from strips which would have to be left between the hedges and drainage channels to give room for clearing. The total amount of land taken would, however, be insignificant compared with that used by tree-belts. On balance, hedges

may well be worth while, at least in the worst blowing areas, bearing in mind the fact that some of the fens are as valuable as any land in the country. Small intensively cultivated fields are already the rule in this area, so that a great deal of subdivision would not be necessary. Those advocating the establishment of hedges considered that, after the initial expenditure, costs of maintenance should not be high provided that it was possible to trim the hedge mechanically. Elder, alder, lilac and privet were suggested, though expense in growing the last two—which form highly effective windbreaks—might be excessively high. There was less support for willow hedges, which tend to become patchy.

In the Breckland the whole situation is different. Support for hedges is very limited, partly because of the size of fields (30 acres is a typical field area) but mainly because of the rabbit problem. This pest makes use of sand-drifts under hedges, and many farmers have been driven to bulldozing their hedges, considering soil blowing to be the lesser of two evils. The expense of netting would be great, and as even a high hedge protects only a fraction of a Breckland field, it is, in the opinion of the farmer, better removed. Only three farmers—all in less sandy areas—spoke in favour of hedges ; seven (out of twenty-four visited) approved the extensive use of tree-belts, and a further nine thought they might have a value in protecting limited amounts of land.

Hedges and tree-belts have a number of features in common—but varying in degree—which adversely affect crop yields. Both rob the soil of moisture and plant foods, but tree-belts, because of their extensive root spread, have a much more serious effect than hedges. Moreover, in the black fen, the roots have a tendency to follow the surface peat layer so that they not only rob the soil but may interfere with ploughing. Yields may also be reduced by the shade cast by windbreaks, and here again tree-belts are more harmful than hedges because of their greater height. The point also arises that a windbreak aligned at right angles to the prevailing south-westerlies will cast an evening shadow over a very wide area on its north-east side. The harbour given to weeds—which can only be cleared by the use of expensive hand labour—harmful insects and birds is further quoted as an argument against both tree-belts and hedges. Then there is the cost of establishment and maintenance, especially with tree-belts, which have been compared unfavourably with that incurred by using alternative measures of protection. While in the fens netting against rabbits is hardly necessary, the shallow-rooted trees may, in this region, be sufficiently loosened by waterlogging for them to be blown over by strong winds. This happened after the 1946 floods. The final argument is concerned with the time factor. Whereas other measures come into operation immediately or within a year or so, it is many years before any shelter benefit is felt from a newly-planted belt of trees, and the problem of wind erosion is becoming more and more urgent as the fine, fertile elements of the soil are progressively dissipated by the wind.

# ROOFING TRENCH SILOS TO PRESERVE SILAGE QUALITY

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Rainwater seeping through the top layers of silage in a trench silo can cause a marked deterioration in feeding value. Putting up a simple roof, such as that described in this article, is very worthwhile consideration.

THE trench or pit silo has become very popular with farmers throughout the British Isles during the recent years of rapid expansion in silage-making. This type of silo has many advantages, especially on the smaller farm. There is little difficulty in choosing a site for the silo, whether it be for temporary or permanent use. It is comparatively cheap and easy to make, and is economical of labour not only during filling but also when being emptied. It is important, however, to mention a particular disadvantage of this type of silo compared with a tower silo; that is, the very much larger surface of the silage that is exposed, and the accompanying difficulty of providing cover. It is the purpose of this article to show how an adequate and comparatively cheap roof over a trench silo in wet areas can prevent deterioration in the quality of the top layers of silage.

When a silo is made on a permanent site, as is often done on the small farm for convenience in feeding, the extra expense in lining the side walls with concrete is well worth while and will eliminate side waste in the silage if reasonable care is taken when filling. There are many silos, however, in which there is considerable spoilage—even total loss—in the top layers of silage, due to exposure to the weather. A covering of soil or other material is useful for top consolidation, and will, at the same time, absorb or run off a certain amount of water. But in districts of high rainfall this is not enough to prevent waste, and unless the silo is covered with some form of roof the seepage of rainwater into the silage will bring about secondary fermentation and loss in quality for some depth into the silo.

Variation in the quality of silage taken at different depths in trench silos which had not been roofed has been mentioned by Brown and Heaney(1), who noted that " the top layers had a lower content of dry matter, larger amounts of butyric acid and less lactic acid. It would seem that penetration of water through the soil covering resulted in secondary decomposition leading to the production of butyric acid in the top layers." This observation led us to closer examination of the problem in the 1950–51 and 1951–52 seasons, when experiments were carried out at the Agricultural Research Institute, Hillsborough, to compare the quality of silage made in roofed and open trench silos.

**A Cheap, Waterproof Roof** Particulars of the general construction of the silos in these experiments have already been given by Morrison and Heaney(2), and a description of the temporary roof is given below. The actual silo which was roofed for the purposes of the experiments is 43 feet long and 12 feet wide at the top. Running along the top of each side wall and bolted to it is angle-iron (3 inches × 3 inches × ¼ inch). The roof consists of curved corrugated iron sheets, and for ease

in handling it is made in separate sections, with three sheets of standard width to the section. The sheets are 8 feet long, and two are required to span the silo. This allows an overlap of 2½ feet in the middle, which gives strength to maintain the curvature without additional support. The ends of the sheets at each side are nailed to wooden purlins (3 inches × 2 inches) which fit inside the angle-iron on top of each wall (see p. i of the art inset). Iron pins are pushed through holes in the wooden purlins and the angle-iron to prevent the sections being blown off the silo. As the silo is being emptied, each section of the roof can be removed quite easily by two men, and stored in a small space. One section is fitted with simple type rollers, two on each side, which run on the angle-iron. This section remains on the silo, providing a simple but effective movable roof over the link of silage being cut out.

With reasonable care in handling, this temporary roof should last for many years. While it may not have the advantages of a permanent roof of the Dutch barn type, it is comparatively cheap to make, and in practice has proved very satisfactory. In 1952 a similar type of roof was made for a trench silo 45 feet long and 12 feet wide at the top, with a capacity of 60 tons. The curved corrugated iron sheets here are 9 feet long, and the total cost of the roof (including the labour in making it) and of the angle-iron was £69. Little difficulty should be experienced in covering wider silos with this type of roof by using curved sheets 9 or 10 feet long and allowing for an overlap of about 2 feet in the middle.

**Roofed versus Open Silos** In 1950 two silos were filled with grass from two- and three-year-old leys. Filling was done simultaneously, a few trailer loads of grass being weighed into each silo in turn, thus keeping the amounts and composition of the herbage similar in both. Molasses was added at the rate of 1½ gallons per ton of grass. Filling began on June 9 and ended on June 20. Consolidation by tractor was continued for a few days, when both silos were sealed with about six inches of soil. One silo was left uncovered from the time filling began, but no rain was allowed to get into the other silo, which was covered with tarpaulins while being filled and afterwards with the corrugated iron roof which has already been described.

In 1951 the same two silos were filled, from June 8 to 18, with grass from a four-year-old ley. The procedure during filling was similar to that in the previous year, except that only one gallon of molasses was added to each ton of grass, and both silos were left uncovered until they were sealed with about six inches of soil. One silo was then completely covered with the corrugated iron roof. Tarpaulins were not used to exclude rain from this silo while it was being filled, since it was suspected that these had been the cause of some mould development in the silage the previous year. (It seems likely that this was the explanation since the silage made without tarpaulins in the same silo in 1951 was entirely free from mould.)

Rainfall figures were noted each year for the period during which the uncovered silo was exposed. From the time filling started on June 9, 1950, until the first of the silage was removed from the uncovered silo on January 28, 1951, a rainfall of 30.95 inches was recorded. From June 28, 1951, when the corrugated iron roof was placed on one silo, until the first of the silage was taken from the uncovered silo on March 3, 1952, the recorded rainfall was 26.38 inches.

Silage samples were taken each year as the silos were being emptied. In the first experiment, 30 samples were taken from three levels—top,

middle, and bottom—along the length of each silo, and in the second experiment 12 samples were taken in the same way. Determinations of dry matter, *p*H value and crude protein content of the samples were made by the Chemical Research Division of the Northern Ireland Ministry of Agriculture. The following average figures were obtained :

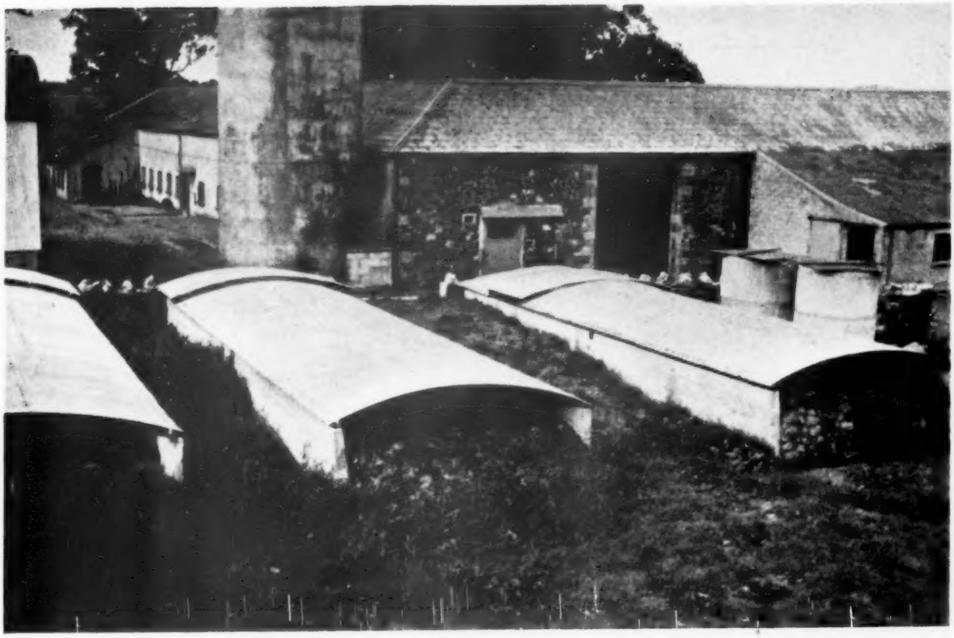
| | | 1950–51 | | | 1951–52 | | |
|---|---|---|---|---|---|---|---|
| | | Top | Middle | Bottom | Top | Middle | Bottom |
| Percentage dry matter in fresh silage | Silo with roof | 25.1 | 25.5 | 26.6 | 20.9 | 21.5 | 20.7 |
| | Silo without roof | 16.0 | 22.4 | 23.0 | 16.0 | 17.4 | 21.7 |
| *p*H | Silo with roof | 3.9 | 3.9 | 3.9 | 4.1 | 4.0 | 4.1 |
| | Silo without roof | 5.0 | 4.1 | 4.2 | 4.6 | 4.4 | 4.1 |
| Crude protein percentage of dry matter | Silo with roof | 13.1 | 13.7 | 13.0 | 13.7 | 12.2 | 15.7 |
| | Silo without roof | 12.8 | 12.5 | 12.3 | 12.6 | 12.9 | 13.6 |

**Effects of Rainwater** The results obtained from these two experiments demonstrate the significant effect of rainfall on silage quality under the climatic conditions of Northern Ireland. The degree of spoilage will, of course, depend on the amount of rain falling on the silo and on the type of material which is put on top of the silo after filling. There are many areas in Britain where the rainfall is comparatively high, and where a few inches of soil or other absorbent material on top of the silo will not prevent rainwater from seeping into the silage. In addition, rainwater reaching the silage through a soil covering may carry with it bacteria which can lead to undesirable fermentation in the silo. Such deteriorated silage has been seen in silos consolidated with soil-laden tractor wheels.

There seems little doubt that where silage is exposed to the weather the seepage of rainwater into the silo adversely affects both the dry matter and the *p*H of the silage for some considerable depth. The loss in dry matter content shown in the above results is most important. The decrease in percentage dry matter content of 3–9 per cent in the middle and upper layers is accompanied by losses of approximately 12–35 per cent in the nutritive value of the fresh silage on a weight-for-weight basis. In the opinion of the writers, no farmer can afford such further losses in the quality of his silage after ensiling, for once this excess water has entered the silage, only the animal can eliminate it. Any practical steps which can be taken to increase or maintain a high dry matter content in silage is advantageous in a feed which normally contains too much water.

The results given for *p*H indicate the comparative lack of acidity in the top layer during both years in the open silos. It is generally considered that butyric acid is present in silos in such amounts as to give typical rancid silage at *p*H values of 4.5 or more. This was the type of silage found in the top layers in both years, and when one considers that the bottom layers, which are generally the "sour" layers in most tower silos, actually had the lowest *p*H values, the drastic effect of seepage on quality in the upper layers becomes more obvious.

Protein content should not be the only yardstick used in assessing the quality of silage, although it is of considerable importance. The amount of silage which has to be fed for a given purpose is affected by its dry matter content, and this becomes especially important where silage makes up a high proportion of the animal's ration. Thus a fattening bullock fed entirely, or mainly, on silage may not be able to eat enough to produce maximum liveweight gain unless the silage has a high dry matter content.



Trench silos with temporary corrugated iron roofs; the movable sections are at the far end.

Photos: *Agricultural Research Institute of N. Ireland*

**A Breckland**

The blow starts with merely a surface drift. Then (*below*) as it mounts in intensity, the furrows at right angles to the direction of the wind are filled with sand, while those parallel with the wind (seen in the foreground) are continually scoured. Provided the blow does not increase in strength, hedge protection would probably arrest the sand.

Photos: *Mustograph*

Blow

The blow at its height. The sand has reached at least 100 feet. Some of the finer sand would clearly pass over the highest tree belt.
The end of the blow. Spring-sown seed, soil and fertilizers have been swept away, leaving the sand banked against the hedge to provide a breeding ground for rabbits.

Photos: *Mustograph*

As the silo is being emptied, each section of the roof can be removed quite easily by two men.

Photos: *Agricultural Research Institute of N. Ireland*

Experience has shown that it is more difficult to get silage with a high dry matter in comparatively shallow trench or pit silos than in tower silos. Nevertheless, a dry matter of 25 per cent or thereabouts can be obtained in a trench or pit silo if the herbage is reasonably dry when put into the silo and a temporary or permanent roof is provided to exclude rainwater. The above results clearly show an appreciable reduction in the dry matter of silage which, apart from the covering of soil, was left exposed to the weather over a period of some months.

It is interesting to comment on the marked difference in the dry matters of the silage made in the roofed silos in the two consecutive years, as the type of leys cut for silage and the botanical composition of the herbage were very similar in both years. Despite this, the average dry matter of the silage in 1950 was 25.7 per cent, as against 21.0 per cent in 1951. The difference was due mainly to the amount of moisture in the grass during the filling of the silos. In 1950 the weather was mainly dry while the silo was being filled, and the grass was cut and carted in a relatively dry condition. There was a marked difference in 1951 ; the grass was in a much wetter condition when put in the silo, due to showery weather at the time of filling. These differences in dry matter confirm the opinion now generally held that silage-making is not entirely independent of weather conditions, and that the dry matter of silage will be much lower where the herbage has been filled into a silo in a very wet condition. Indeed, it has been noted by the writers during conservation experiments in trench silos that the dry matter content of the grass can increase by about 7 per cent during a sunny day after morning dew. Thus the time of the day at which the grass is cut may be important in obtaining high dry matter contents.

### References

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# AMMONIA GAS AS A FERTILIZER

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The possibilities of ammonia gas as an alternative to sulphate of ammonia have been examined at Cockle Park.

OF the various nitrogenous fertilizers sold in this country, sulphate of ammonia is the most popular, but it is interesting to note that in the United States of America, more nitrogen is sold as gaseous ammonia than as sulphate of ammonia. Rather surprisingly, there are no records of the use of ammonia gas as a fertilizer in Britain, although ammonia gas has much to commend it. It is easily the most concentrated nitrogenous fertilizer (1 ton contains almost as much nitrogen as 4 tons of sulphate of ammonia), therefore its use offers appreciable economy in transport. Ammonia gas is, moreover, neutral in its action in the soil, in contrast to the slightly acidic effect of sulphate of ammonia. As regards cost, too, ammonia

gas should compare very favourably with sulphate of ammonia ; indeed, in North America, it is much cheaper on a unit basis. Another advantage is that ammonia gas is not dependent, as is part of our sulphate of ammonia production, on possible fluctuations in the supply of imported sulphur.

Against these advantages, we must admit that ammonia is a rather dangerous material to handle, so that its storage both at the factory and on the farm would present a problem. Further, where a complete fertilizer is needed, two operations and two machines would generally be necessary—the application of phosphates and potash with an ordinary fertilizer distributor and then the injection of ammonia separately. The problem may be partially solved by ammonia injection on a contract basis by specialists in weed and insect control who are already experienced in handling chemicals. Most of the rowcrop nitrogen could perhaps be applied before the main spraying season began, and the ammonia could easily be collected at a railway siding or central depot in four-wheel-drive vehicles which would also inject it in the field. It would not be unreasonable to expect to cover an average of 50 acres a day.

On balance, it is very doubtful whether, in existing circumstances, any change in practice can be justified in this country. Haulage in a relatively small country is a minor item in the final cost, whereas in North America substantial economies are possible in this respect.

**Cockle Park Experiments with Soil Injection** Despite this conclusion, however, simple exploratory experiments were carried out at Cockle Park in 1951 on a crop of marrowstem kale in Back Butts Field. The soil was of medium texture (clay 23.7 per cent), slightly acid ($p$H 5.48), and derived from carboniferous drift material.

Injection of ammonia into the soil proved to be a quite straightforward operation. A steel tube was welded down the rear of a knife coulter, and the ammonia was blown down this tube. When it moved through the soil at any depth greater than 2 inches, the ammonia was completely adsorbed. No trace of the smell of ammonia was noticeable at the surface ; the ammonia would not, however, be retained so effectively in a dry, sandy soil.

In the experimental apparatus a rigid coulter was used, but to avoid breakages a spring-mounted retractable coulter would obviously be more satisfactory. The whole equipment was carried on a hydraulically-mounted potato-planter from which the ridging bodies had been removed. A cylinder of ammonia (compressed to liquid form) lay in the box, with a pressure gauge and stainless steel needle valve at the outlet. The rate of gas flow was measured by a simple U-tube type of flow-meter carried on the rear of the box.

Injection was made at varying depths ; for this particular soil and crop, the optimum depth proved to be about 4 inches. Laterally, the best results were obtained by running the coulter down the centre of the ridge before sowing the seed, but any distance up to 9 inches from the plants was reasonably satisfactory. To test for possible toxicity, dressings of ammonia equivalent to 12 cwt. per acre sulphate of ammonia were applied down the line of the drill before both sowing and transplanting. No ill-effects could be detected in either case, but in an alkaline soil, the temporary increase of the $p$H figure might cause " trace element " deficiency.

*On Kale*. In a series of replicated plots, sulphate of ammonia was applied before sowing kale at three levels—2, 4 and 8 cwt. per acre, and the same amounts of nitrogen were given as gaseous ammonia in parallel plots.

**Mean Yields Obtained in a Series of Replicated Plots**

| | Control (No. N) | 47 lb. N/acre | | 94 lb. N/acre | | 188 lb. N/acre | | St'd Error |
|---|---|---|---|---|---|---|---|---|
| | | as S/A | as Amm. | as S/A | as Amm. | as S/A | as Amm. | |
| Fresh wt. of kale (*cwt./acre*) | 232.7 | 366.5 | 281.8 | 251.1 | 317.0 | 324.2 | 348.2 | 20.4 |
| % dry matter | 14.1 | 12.6 | 13.5 | 12.3 | 11.6 | 11.2 | 10.7 | 0.53 |
| Wt. of dry matter(*cwt./acre*) | 32.8 | 46.2 | 38.1 | 31.0 | 36.9 | 36.3 | 37.2 | 4.7 |
| %Crude protein in dry matter | 13.1 | 16.0 | 15.2 | 17.1 | 17.3 | 22.3 | 22.3 | 1.0 |
| Wt. of crude protein (*cwt./acre*) | 4.3 | 7.4 | 5.8 | 5.3 | 6.4 | 8.1 | 8.3 | 0.85 |

S/A = Sulphate of Ammonia. Amm. = Ammonia.

Soil variability caused considerable differences between one plot and another and is reflected in the high standard errors. Both types of fertilizer, it will be noted, gave highly significant increases in the fresh weight of kale per acre but, owing to the progressive lowering of the dry matter content by successive increases in the dressings of nitrogen, there was no significant increase in the actual yield of dry matter per acre. The protein content of the dry matter did, however, increase and, with the heaviest dressings of nitrogen, the yield of crude protein was almost doubled. Taking the figures as a whole, it cannot be said that there is any difference in efficiency between the two forms of nitrogen.

In a second series of experiments, ammonia was dissolved in water and sprayed on to the soil surface. Here, particularly with heavy dressings, there was obviously considerable loss of nitrogen to the atmosphere, and ammonia in this form was far less efficient than either the gas or the sulphate of ammonia. Had the solution been injected, its efficiency would undoubtedly have been higher. Incidentally, it may well be that under certain conditions sulphate of ammonia itself is slightly more efficient where it is actually covered by soil.

*On Permanent Pasture.* The same apparatus was used to inject ammonia gas in an adjoining permanent pasture field at a depth of 2 inches. It was not possible to measure yields but from the colour of the sward it was clear that gaseous ammonia, like sulphate of ammonia, gave a response in 10–12 days. Gaseous injection at 5-6 inches gave a response in 20–30 days. Injection at two different levels may therefore give a considerable spread in nitrogen availability.

It is not suggested that gaseous ammonia is a suitable fertilizer for grassland, for the draught of the injection coulters would be much too high. Rowcrops, on the other hand, could be treated much more easily , and there is no reason to believe that ammonia gas would be any less efficient as a source of nitrogen than sulphate of ammonia. Should sulphur become more difficult to obtain, or other economic factors swing the balance in favour of gaseous ammonia, ammonia gas might well be introduced as a fertilizer in one or two areas where considerable acreages of rowcrops are grown.

# IMPLEMENT ACCOMMODATION AND SIZE OF FARM

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**Is it better to protect farm implements by housing them properly or to leave them out in all weathers and meet the cost of more frequent repairs and replacements ?**

DURING and since the war years British farming has become fully mechanized ; the tractor has largely supplanted the horse, the combine bids fair to oust the binder, and an impressive array of new machines—crop loaders, balers, beet harvesters and the like—have helped to make good the shortage of labour and expanded the nation's inventory of agricultural machinery and implements. The money invested in plant and equipment runs into millions of pounds, and up and down the country the housing and care of valuable machines and implements have become urgent problems. Complex machinery quickly deteriorates if not protected from the weather, blowing dust and tampering by children and inquisitive adults. On the other hand, the cost of new accommodation, of converting vacant stables to implement and machinery stores and of reconditioning existing sheds has risen so high that the wisdom of providing shelter for implements and machinery has been seriously questioned ; would it not be more economical to leave equipment in the open and accept the higher cost of maintenance and replacement which excessive weathering will entail rather than invest money in the improvement of old buildings or the erection of new ones ? Interest on the money invested, the wasting of capital through depreciation of the building and the cost of continual maintenance of the fabric might well prove the bigger bill.

Investigation of this pressing problem has recently been made at the request of the Ministry of Agriculture by the Department of Estate Management, Cambridge University. The problem was looked at from all sides. One of the many questions raised was how to tell whether a farm was equipped with adequate implement accommodation. The question was simple enough, but the answer proved difficult ; indeed, it would be going too far to claim that a fully satisfactory answer has yet been found. Some success was achieved, but more work remains to be done. Nevertheless, the general impressions gained are instructive, and a brief reference to them may be of interest and help to owners and tenants facing the problem of providing implement accommodation.

**Guide to the Accommodation Required** The requirements of the particular farmer at the time when new implement accommodation is being planned give some indication of what an adequate provision might be, but they cannot be relied upon as a sure guide to long-term planning. One farmer may have over-capitalized his holding and another be working with insufficient tools. If implement accommodation is to be adequate and economic, it must be sufficient to house every implement and machine that needs to be housed and is necessary to work the holding according to the normal requirements of reasonably skilled farmers, and it must not exceed those requirements. This is obvious enough. Difficulty arises when an attempt is made to establish what are the normal requirements of a holding for field equipment. Many agricultural machinery experts say that standards cannot be set. What is full equipment in the hands of one man may be too limited or quite unsuitable for the needs of another. This is probably true of smaller implements,

but data collected from forty farms of widely varying size and type in the course of the investigation suggested something of a normal relationship between area of land cultivated and the numbers of implements and machines needed to work it.

On farms of less than 100 acres the personal whims and fancies of the farmer complicated the picture. Some of the smaller farmers preferred to borrow equipment from neighbours or rely upon agricultural contractors ; others stocked their holdings with equipment that was seldom used. The composition and range of implement and machinery inventories on the larger farms were more closely related to the size of the farms. All farms of over 100 acres, except a grass farm of 265 acres, carried at least the same number of certain implements and machines. This minimum inventory was :

| | |
|---|---|
| 1 | tractor |
| 1 | 2-furrow plough |
| 5 | other tillage implements |
| 1 | drill |
| 1 | grass mower |
| 1 | hay-rake, or side-delivery rake or hay-sweep |
| 1 | binder |
| 3 | carts, wagons or trailers |

The amount of accommodation that this equipment requires, assuming the equipment needs to be under cover, is 940 sq. feet, and this area may be regarded (so far as the findings of the investigation are universally valid) as a standard minimum of accommodation for farms over 100 acres. The figure of 940 sq. feet was also shown to be the minimum requirement of all farms with 20 or more acres of tillage land, irrespective of the total acreage of the farm.

**Relationship between Size of Farm and Equipment** Time did not permit separate studies of all types of machine and implement to be made so as to observe how numbers were affected by the size of the farm. Separate studies were made of four types : the tractor, as representative of equipment used on both arable and grassland but of greater significance for arable conditions ; the plough, as representative of essentially arable land equipment ; the grass mower, as a grassland counterpart ; and transport equipment, as representative of all equipment having equal significance for arable and grassland farming. Attention was also paid to the total numbers of implements and machines on the farms and the relationship these numbers bore to farm area.

The figures demonstrated two important features. One was the tendency for the number of implements and machines needed per acre to be either a direct ratio or inverse ratio to the size of the holding. Where the first operates, a holding double the size of another wants twice as many implements. The second means that the requirements of a 300 acre farm, for example, are not exactly three times the requirements of a 100 acre farm, but acre for acre something less. This is important and shows how foolish it is to suppose that adequate accommodation is always in direct ratio to the size of the farm. The inverse ratio principle was true of the total number of implements and machines on a holding, the number of tractors and the number of transport items, but it governed neither the relationship between the number of " plough-furrow multiples " (that is, the number of mouldboards as distinct from the number of ploughs) and the area of arable land nor the number of grass mowers and the area of grassland.

The figures for tractors illustrating the inverse ratio principle were :

| Size of Farms *acres* | Tractors per 100 Total acres |
|---|---|
| 0—50 | 2.0 |
| 50—100 | 1.6 |
| 100—200 | 1.4 |
| 200—300 | 1.2 |
| 300—400 | 1.0 |
| 400—500 | 0.75 |

The number of plough-furrow multiples and the number of grass mowers was a direct ratio of the area served. Whatever the size of the arable land area, the figures indicate a need for one plough-furrow multiple to every 30 acres of arable land, and one grass mower to every 150 acres of grassland as a maximum.

The other important feature was the influence that farming type has upon the relationship of implement numbers to farm size. The total numbers of implements and machines on each farm arrayed in order of area seemed to bear some relationship to the size of the farm, but when the farms were sorted into farming types the relationship was more clearly seen. Farming type, therefore, is important. The figures for transport equipment on the forty farms are a good illustration. The number of transport units—carts, wagons, trailers, lorries, vans—per 100 acres fluctuated with the size of holdings in inverse ratio and with the type of farming. On dairy farms, heavily cropped arable farms, market gardens, farms carrying an exceptional number of horses as well as high tractor establishments, and farms remotely situated relying upon their own transport for marketing, the relationship between size and numbers was :

| Size of Farms *acres* | Units per 100 acres |
|---|---|
| 0—50 | 9—6 |
| 50—100 | 6—5 |
| 100—200 | 5—3 |
| 200—400 | 3—2.5 |
| Over 400 | 2.5 and less |

with the higher number of units per 100 acres on the arable farms rather than on the dairy farms. On sheep farms, general mixed farms, light arable farms, cattle rearing and breeding farms, holdings relatively limited in area, and farms associated with good marketing facilities, the relationship was :

| Size of Farms *acres* | Units per 100 acres |
|---|---|
| 0—50 | 4 |
| 50—100 | 4—3 |
| 100—200 | 3—2 |
| 200—400 | 2—1.5 |
| Over 400 | 1.5 or less |

with the higher numbers of units per 100 acres on the mixed and light arable farms rather than on the sheep grazing, feeding and rearing farms.

**Calculating Accommodation Needs** If sufficient figures of this kind were known it would be possible, given size and type of a farm, to make a reasonable estimate of the range and number of implements and machines the farm would need. From the result a calculation of the requirements of the farm for implement and machinery

accommodation could be made by multiplying the number of implements and machines of each type by the average overall space required for storing an implement and machine of that type. Calculations of such averages were made during the investigation from a wide range of varieties with proper weight given to the more popular models. The results were tested in the field by comparing an area of implement cover with an estimate, based on the averages, of the accommodation needs of the equipment actually housed under that cover.

Before estimates of accommodation needs can be made by the method just described, the researches into the relationships between size of farm and the number of implements and machines required on the farm must be taken further. During the recent investigation a broader based approach was followed and a fair approximation to the same results obtained.

The average storage needs of the different types of equipment were used to estimate the accommodation requirements of each of the forty farms involved in the investigation. The results demonstrated directly the relationship between area and total accommodation ; as with implement numbers, the pattern of the relationship was made clearer by grouping the farms into farming types.

The general trend of the figures suggested the following amount of accommodation per 100 acres :

| | | Sq. ft. of Accommodation Required per 100 acres |
|---|---|---|
| 1. | Rearing, grass-dominant, large arable, marsh and sheep farms .. .. .. .. .. .. .. | 500—1,000 |
| 2. | Dairying, mixed and heavy arable farms .. .. | 660—1,800 |
| 2. | Intensive arable farms, market gardens, etc. .. .. | 1,000—2,800 |

The inverse ratio principle was also prominent. The larger the farm the less was the amount of accommodation needed per 100 acres. These figures broadly represent the change in requirements per 100 acres on farms ranging from 20 to 700 acres.

**Standard Bays per 100 acres** On paper, the figures would enable accommodation requirements to be calculated to the nearest square foot. This would be of little practical value. Total accommodation is one thing ; the way it is planned and provided for another. To build an implement shed to a given superficial area might prove a costly undertaking—if not an impractical one. Accommodation requirements obviously cannot be decided to the nearest square foot. They have to be expressed in broad figures which take into account the influence of structure upon design and the needs of economical arrangement of equipment within a shed. For these reasons the amount of accommodation is best expressed in terms of the number of bays instead of square feet. The recent investigation at another stage showed the practical worth of an accommodation bay of 330 sq. feet ; in an open-fronted shed a bay of this area would be 15 feet wide, with a depth span of 22 feet. The figures given above, rounded to the nearest 330 sq. feet-bay, give the following range of requirements for farms of 20–700 acres :

| | | Bays per 100 acres |
|---|---|---|
| 1. | Rearing, grass-dominant, large arable, marsh and sheep farms | 3—2 |
| 2. | Dairying, mixed and heavy arable farms .. .. | 5—2 |
| 3. | Intensive arable farms, market gardens, etc. .. .. | 8—3 |

A rough calculation based on these figures shows that a farm of 250 acres in group (1) would need 6 bays, a farm of similar acreage in group (2) 8 bays, and a farm of similar acreage in group (3) 11 bays. The figures only illustrate general tendencies. As such, they are useful broad standards, but they must not be regarded as having a more precise significance.

This article has dealt only briefly with one of the many aspects of the problem of providing adequate and satisfactory implement accommodation on the farm. The Cambridge research has, however, provided other useful information which the Ministry of Agriculture proposes to embody in a new bulletin dealing with implement accommodation on the farm, and by leaflets covering important associated problems such as the provision of fuel stores and farm workshops on the farm. These publications will be announced in the farming press in due course—*Editor.*

# BLINDNESS IN EARLY CAULIFLOWERS

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Little is known about the reason for blindness in early cauliflowers, but recent investigations suggest that low temperatures when the plant is at a very early stage in its growth may have some bearing on it. Pending further research, growers can best guard against this trouble by paying careful attention to the selection of varieties and the cultural methods used.

THE problem of "blindness" in early cauliflowers has aroused much concern during the last few years ; more particularly has it come to the fore this season, when growers over a wide area have suffered considerable losses due to the trouble. At this point, it is perhaps necessary to distinguish between "whiptail" and "blindness". The former, caused by molybdenum deficiency, has been recorded in this country only on acid soils. Symptoms in the field include the cupping and puckering of leaves, together with a marked reduction in the laminae and the formation of stub-like growing points. The fault to be considered here is quite distinct, as it has been found to occur on both acid and alkaline soils, and the type of blindness is of a rather different nature from that associated with whiptail, the plants appearing normal until suddenly it can be seen that the growing point has aborted. This appears to take place at varying times in individual plants among a batch of overwintering cauliflowers ; those which appear normal when planted out in March may show blindness a short time afterwards. Such plants, if left in the field, frequently produce many adventitious shoots later in the season.

Reports of blindness have been widespread, especially during the seasons 1950–51 and 1952–53, though little of this trouble appeared in the intervening year. At times it has been noted from such widely separated areas as the Vale of Evesham, Sussex and the East Riding of Yorkshire. Such knowledge of the trouble naturally comes mainly from growers, and it is sometimes difficult to know the exact cultural conditions to which the plants have been subjected. It seems clear, however, that blindness has generally been most marked among overwintered plants, and that it has not usually

shown up to any extent until planting time or later. (Though this may be merely because there would be no reason for the grower to examine the plants so carefully at an earlier stage.)

From varying reports it would seem that certain varieties are more prone to this trouble than others, susceptible varieties including Remme, Meteor and All the Year Round. This season one case has come to my notice where more than 33 per cent of the variety Meteor and more than 66 per cent of the variety Remme from overwintered sowings were found to be blind at planting time. In fact, Remme, a variety grown widely in the past, is much less popular today partly because of this defect.

Such reports, usually couched in rather vague terms, can only lead one to suppose that the overwintering period may have some effect on the development of the plants, perhaps due to prolonged periods of low temperature. The preliminary investigations and observations which we have made during the last two years have therefore been mainly concerned with these aspects, that is, the comparison of spring versus autumn sowing, using several different varieties. In the first instance, our aim was to discover if there is any real evidence for thinking that overwintering is an important factor in affecting the incidence of blindness, and to investigate the differences said to be shown between one variety and another.

**Trials at Bristol** A small-scale trial in 1951–52 yielded little information, since there was very little blindness even among overwintered plants of varieties that had been reported as susceptible. However, this was a mild winter with few prolonged cold spells compared with the following year, 1952-53, during which we saw a high percentage of blind plants under certain conditions.

In the 1952–53 trials autumn sowings of All the Year Round and White King were made on October 1 in frames and were pricked off into $3\frac{1}{2}$-inch pots in John Innes Potting Compost on October 23. This time and method of sowing would approximate to that used by many growers. The plants were overwintered in frames, being given, quite intentionally, rather colder conditions than most growers would consider desirable. It is of interest to note that the night temperatures were particularly low from early November to late December, the temperature in the frames being frequently at or below freezing. There was, in addition, a spell of nine days from November 29 to December 7 when the temperature was never above freezing point either day or night. Rather surprisingly, there were few signs of frost damage at the time, though the plants made little growth until well into March.

The plants were examined carefully for blindness at frequent intervals, but apart from a few malformed at the seedling stage, and which could be easily rogued, little blindness was seen until the early spring. A certain amount was recorded whilst the plants were still in frames, but by far the most showed later in the field, there being a loss of 50 per cent in All the Year Round after planting out (see the table on p. 284).

The spring sowings were made on January 29, 1953, using the varieties All the Year Round, White King, and Remme, which we had unfortunately not been able to include in the autumn sowings. Seed used for both spring and autumn sowings came from the same source ; this is important, as it has been thought in the past that the degree of blindness shown in batches of plants may be attributed to different sources of seed.

These plants were raised in 3½-inch pots in John Innes Potting Compost No. 1 in a heated glasshouse, where the minimum night temperature was maintained at or above 40°F. until late March, when the plants were hardened off in frames prior to planting out. They were frequently examined carefully to note any blindness present. As with the autumn sowing, a very small number of malformed plants were easily rogued at the seedling stage, but after this very little blindness could be seen throughout the growth of the plants, the most being just over 1 per cent in the variety All the Year Round.

All the plants from the spring and autumn sowings were put out in the field on March 31, the various treatments being laid out in a randomized block arrangement such as is commonly used for variety trials. The land on which they were grown was a silty-clay over limestone with a *p*H of 7 and a fairly high content of soluble phosphate and potash. The usual pre-planting cultivations were given, together with a dressing of a complete compound fertilizer (N 7%, $P_2O_5$ (Sol.) 5% $K_2O$ 5%) at the rate of 5 cwt. to the acre.

After planting out, all the plants, both autumn- and spring-sown, were naturally subjected to identical conditions, this including thirty-nine occasions when the ground temperature fell to 32°F. or below. The air temperature a few inches above ground level could not have been much higher than this. The plants were examined at weekly intervals and blindness was recorded amongst the overwintered plants on varying occasions from 2 to 8 weeks after planting out. The spring-sown plants were examined in the same way but, out of a total of more than 200 plants in the field, only one blind plant was recorded.

It should perhaps be mentioned here that great care was taken throughout to ensure that the plants were free from insect damage, since such attack may on occasions cause symptoms very similar to the blindness under investigation.

**Comparison of Blindness in Autumn- and Spring-Sown Early Cauliflowers, 1952-53**

| No. of Cases of Blindness | Total No. of Plants in each Treatment | Autumn-Sown | | Spring-Sown | |
|---|---|---|---|---|---|
| | | White King | All the Year Round | White King | All the Year Round |
| At germination, due to malformed seed | More than 500 | 7 | 1 | 1 | 2 |
| Pricking out to planting out | 250 | 17 (nearly 7%) | 36 (over 14%) | — | 3 (just over 1%) |
| Planting out to maturity | 72 | 20 (nearly 28%) | 36 (50%) | — | 1 |

It would appear that under our conditions autumn-sown plants are much more prone to this trouble than those sown under glass in spring. After hearing so many reports about the high percentage of blindness in the variety Remme, it was particularly enlightening to find that this variety was quite successful with us when spring-sown. The curd was, in fact, of better quality than the other two varieties grown. Rather surprisingly, too, the spring-sown plants were ready for cutting, if anything, slightly earlier than those of the same variety raised from autumn sowings.

There was also some difference in the occurrence of blindness between the varieties White King and All the Year Round when autumn-sown, though the number of plants grown of each variety was not large enough for too much reliance to be placed on this apparent difference.

**A Possible Explanation** At this stage it is extremely difficult to attempt an explanation of the reasons underlying the transition from a normal to a blind plant on the basis of any known differences in external conditions. Any observations which are made in this direction can be regarded as nothing more than tentative suggestions. If, as seems possible from our experience and from recent work carried out in Holland, temperature, among other factors, influences the incidence of blindness, this would help to explain the increase of the trouble among autumn-sown plants. It is of interest to note that there was a prolonged cold spell early in the winter which affected only the overwintering cauliflowers, and also that cold weather *after* planting out in the field in spring had little effect on the spring-sown plants. Is it possible that very young plants, that is, before they are planted out, are more susceptible to low temperatures than those in the later stages of growth ? Should this be so, it would help to account for a feeling among some growers that late-autumn sowings are more prone to the trouble than those made rather earlier which have become well established before the onset of cold weather.

From recordings of ground temperatures in the Evesham area during the winter months of 1950–51, 1951–52, and 1952–53, it is obvoius that in this district at least there were prolonged cold spells early in the winters of 1950 and 1952, whereas in 1951–52 there were no prolonged cold spells until well into January. As was stated earlier, there was a lot of blindness in 1950–51 and 1952–53 (cold autumn) and little blindness reported in 1951–52 (warm autumn) ; though until we have more knowledge of the problem it is difficult to assess if this is likely to be more than coincidence.

It seems that at present we are still on the fringe of this problem, but even so, it is worth thinking carefully about the possibility of reducing this particular loss among cauliflowers by care in the selection of varieties and vigilant attention to cultural details such as times of sowing and temperature.

# MUMMY WHEATS

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**The results of trials carried out at the Cambridge Plant Breeding Institute suggest that any extravagant claims about the yields obtained from " mummy wheats " should be regarded with considerable scepticism. There is certainly no truth in the belief that these wheats have survived from the times of the Pharaohs.**

" MUMMY WHEATS " have attracted considerable attention in this country in recent years. Botanically speaking, they are only forms of the more familiar Rivet wheat species, *Triticum turgidum*, from which they differ in having branched ears ; this gives them a suggestion of high yielding capacity. Wheats of this type are cultivated over a wide area around the eastern shores of the Mediterranean. They are most commonly found in Egypt and the Nile valley, and forms of these so-called *branching turgidums* have frequently been brought home by tourists and by soldiers stationed in Egypt. The interest aroused by these wheats is by no means new, and it is possible to find records of them as cultivated plants in the writings of Pliny in the first century A.D.([1]).

It is commonly claimed that grain samples of these so-called " mummy wheats " in current circulation were found in the tombs of the Pharaohs, where they have remained dormant since the early Egyptian civilizations. It has been found, however, that authentic grains discovered in such tombs are mostly "Emmer" wheats, belonging to the species, *Triticum dicoccum*, which is distinct from the species *Triticum turgidum* (mentioned above) to which the " mummy wheats " belong. Not infrequently, these grains of Emmer wheat have become distorted during the long period they have lain in the tombs. This distortion has occasionally given them the hump-backed appearance associated with *T. turgidum*, but expert examination has shown that this is a purely artificial effect sometimes associated with the carbonization of the grains which often take place in the course of thousands of years' storage under such conditions([2]). *T. turgidum* has never been identified from the tombs, and Tackholm ([3]) suggests that the viable samples of grain claimed to have been found in them from time to time are, in fact, counterfeits sold by unscrupulous vendors. He adds that such grain is in no way associated with the tombs, but that it had been "planted" in convenient places for recovery and sale to gullible purchasers.

Although it is possible that *T. turgidum* may occasionally have been cultivated by the ancient Egyptians, no traces of this species have ever been found amongst relics of their civilizations. It is also inconceivable that wheat grains could have remained viable for the thousands of years that have elapsed since those civilizations. To prove this point, experiments have been made on the viability of authentic grain samples from the tombs of the Pharaohs. Tackholm states that all such samples are taken to the Cairo Museum of Agriculture, and that of the many hundreds of grain samples which have been examined, not one has been capable of germination. Modern knowledge on the biology of germination and viability of the grain of cultivated cereals indicates that under good conditions of storage the life of dormant grain is measured in tens of years, not hundreds.

**Cambridge Trials with Branching Turgidum** Although these *branching turgidum* forms may not be traceable to Egyptian or other ancient tombs, it is still a matter of interest to examine the extravagant claims commonly made about their yielding capacities. A close investigation often shows that the conditions in which they are grown by people acquiring small samples are extremely artificial, frequently being nearer to garden conditions than to those found in the field. For this reason, and also because of the very high yields claimed by Russian workers for wheats of this type, it was decided to carry out trials in the field at the Cambridge Plant Breeding Institute with two samples of *branching turgidum* in its wheat collection. The first of these was claimed to come from the tombs of the Pharaohs, and was called Osiris after the Egyptian fertility god ; the second had been received in a collection of wheat varieties sent from Turkey. It is clearly not justifiable to make any general statement about the value of *branching turgidum* wheats in British agriculture from trials conducted with only two varieties, but these trials do, however, give an indication of the behaviour of this type of wheat compared with Rampton Rivet, the standard variety of *T. turgidum* cultivated in this country. Trials of this kind also show the deceptiveness of appearances and the danger of optimistic claims made from observations of a few plants. The results obtained are confirmed by trials carried out by Lenglen in Switzerland, who found that the yield of a *branching turgidum* wheat was reduced by as much as 70 per cent after a severe winter(4).

The Cambridge trials were autumn sown and consisted of small-scale randomized blocks, with Rivet as control. In one of the years during which the trials took place, detailed counts were made of plant establishment in autumn and spring, of the number of fertile ears per plant, of the number of grains per ear, and of the thousand grain weights of samples of the population. The yield figures and the data obtained from these counts are given in the table.

**Branching Turgidum Trials, 1951-52**

| | Yield per cent of Rivet | | Field Observations 1951–52 | | | |
|---|---|---|---|---|---|---|
| | 1950–51 | 1951–52 | Plant Loss over Winter | Ears per Plant | Grains per Ear | 1,000 Grain Weight |
| Rampton Rivet | 100 (21 cwt. per acre) | 100 (46 cwt. per acre) | *per cent* 3 | 2.65 | 54.9 | 58.7 |
| Turkish Wheat No. 52 | 55 | 68.5 | 15 | 2.09 | 104.9 | 33.1 |
| Osiris | 76.5 | 72.0 | 9.5 | 1.86 | 76.5 | 47.0 |

These trials demonstrate very clearly that at two very different levels of fertility, *branching turgidums* are much lower yielders than Rampton Rivet, in spite of the greatly increased numbers of grains produced per ear. This fact should be treated with some reserve, however, as it was noted that the two *branching turgidums* suffered considerable damage during the winter months, and they cannot, therefore, be regarded as winter wheats. This is particularly significant when it is remembered that the trials were carried out

during the two relatively mild winters of 1950–51 and 1951–52. The extent of the winter damage is partly shown by the figures quoted for plant loss over winter, which were obtained by comparisons of plant establishment in autumn and spring. These do not, however, give the whole picture, because many of the plants that survived the winter were very seriously set back by the cold conditions, and this undoubtedly reduced their yielding capacities. If the *branching turgidums* are not true winter wheats, the figures obtained following an autumn sowing may not give a true reflection of their yielding capacities. Their only possible application to British agriculture would, however, be as winter wheats, sown in the rather specialized areas where Rampton Rivet is at present found. The Cambridge trials may be regarded as giving a fair indication of the value of these wheats under such conditions.

The figures shown in the table explain why the *branching turgidum* wheats fail to give the high yields which their large ears might suggest. The thousand grain weights of these two wheats are very much lower than that of Rampton Rivet, because the grains produced in the supernumerary spikelets are very small and contribute little to the total. The number of ears per plant found in the two *branching turgidums* was much lower than that in Rampton Rivet, in spite of the thin plant due to winter killing. This reduction in ear number must obviously have an effect on the yields obtained, and is of particular importance when we remember that Rampton Rivet itself is normally considered to be a low tillering variety.

Disease attack is a further factor which contributes to the low yields obtained from the *branching turgidums*. Yellow rust was widespread in the two years during which the trials were being carried out, and on both occasions the Turkish wheat was very heavily attacked. The attack on Osiris was not severe, though bad leaf yellowing was reported in June 1951.

To make any general pronouncement on the behaviour of *branching turgidums* , it would be necessary to use a much greater number of varieties and to carry out trials over a wider range of conditions. But the results obtained do suggest that any extravagant claims about the yields obtained from " mummy wheats " should be treated with considerable scepticism, and it can be stated categorically that there is no truth whatsoever in claims that they have survived from the times of the Pharaohs.

**References**

1. C. R. LENGLEN. *Acad. Agric. Fr.*, 1949, **35**, 335-41.
2. G. BRUNTON. *British Museum Expedition to Middle Egypt.* London, 1937.
3. V. TACKHOLM. *Gazette de Lausanne.* 1949.
4. C. R. LENGLEN, *Acad. Agric. Fr.*, 1949, **35**, 572-3.

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**BRITISH STANDARDS INSTITUTION**

**Change of Address**

As from August 17, the new address of the British Standards Institution will be No. 2 Park Street, London, W.1 (Mayfair 9000).

# THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the June 1953 issue of AGRICULTURE (p. 137), the undermentioned publications have been issued.

**MAJOR PUBLICATIONS** *Copies are obtainable, at the prices quoted, from the Sale Offices of H.M. Stationery Office or through any bookseller.*

**Bulletins**

No. 10 Calf Rearing (*Revised*) 1s. 3d. (1s. 4½d. by post)
No. 30 Rats and Mice on the Farm (*Revised*) 2s. 0d. (2s. 1½d. by post)
No. 115 The Construction and Heating of Commercial Glasshouses (*Revised*) 3s. 0d. (3s. 2d. by post)
No. 147 Electric Fencing (*Revised*) 2s. 6d. (2s. 7½d. by post)
No. 152 Intensive Methods of Poultry Management (*New*) 3s. 0d. (3s. 2d. by post)
No. 160 The Housing of Pigs (*New*) 3s. 0d. (3s. 2d. by post)

**Other Publications**

Farm Book-Keeping (*Revised*) 1s. 0d. (1s. 1½d. by post)
Smallholdings organised on the basis of Centralised Services—Land Settlement Association Report and Accounts 1951–52 (*New*) 1s. 0d. (1s. 1½d. by post)

**LEAFLETS** *Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), 19 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from the Sale Offices of H.M. Stationery Office.*

**Advisory Leaflets**

No. 11 Winter Moths (*Revised*)
No. 68 The Carrot Fly (*Revised*)
No. 91 Mangold Fly (*Revised*)
No. 106 Apple Aphid (*Revised*)
No. 170 Pea and Bean Thrips (*Revised*)
No. 183 Narcissus Flies (*Revised*)
No. 201 The Corncrake (*Revised*)
No. 225 Cutworms or Surface Caterpillars (*Revised*)
No. 260 The Common Buzzard (*Revised*)
No. 286 Chrysanthemum Midge (*Revised*)
No. 376 The Control of Weeds in Peas with Dinoseb (DNBP) (*Revised*)
No. 406 Commercial Dahlia Growing (*New*)
No. 410 Red Core of Strawberry (*New*)
No. 413 Verticillium Wilt of Hops (*New*)

**Animal Health Leaflets**

No. 30 Anthrax (*Revised*)

**FREE ISSUES** *Obtainable only from the Ministry (Publications), 19 Chester Terrace, Regent's Park, London, N.W.1*

**Growmore Leaflets**

No. 44 Mole Drainage for Heavy Land (*Revised*)

**Farm Machinery Leaflets**

No. 11 Fertilizer Distributors (*Revised*)

**Other Booklets and Leaflets**

You *versus* Pests—Grey Squirrels (*New*)
Crop Protection Products Approval Scheme—List of Approved Insecticides and Fungicides, 1953 (*Revised*)
The Provision of Smallholdings (*Revised*)
Take Care when you Spray (*Revised*)
Grants for Farm Drainage—Welsh Version (*New*)
Full-Time Agricultural Education in England and Wales, 1953–54 (*Revised*)

## AGRICULTURAL INDEX NUMBERS AND PRICES

### MONTHLY INDEX NUMBERS AND PRICES OF AGRICULTURAL PRODUCTS

INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION)
BASE 1927–29 = 100

| | Unit | Prices used for June 1953 Index | 1953 | | | 1952 | | |
|---|---|---|---|---|---|---|---|---|
| | | | Apl. | May | June | Apl. | May | June |
| All Products .. | — | — | 272* | 250*‡ | 250* | 264 | 242 | 243 |
| Cereals and Farm Crops .. | — | — | 285 | 291 | 298 | 280 | 280 | 283 |
| Livestock and L'stock Products | — | — | 268* | 239* | 236* | 259 | 230 | 230 |
| | | *s. d.* | | | | | | |
| Wheat .. .. | cwt. | 32 6 | 311 | 313 | 315 | 294 | 295 | 298 |
| Barley .. .. | ,, | 30 8 | 284 | 283 | 279 | 300 | 270 | 254 |
| Oats .. .. | ,, | 25 5 | 277 | 274 | 275 | 300 | 287 | 283 |
| Potatoes .. .. | ton | 304 6 | 273 | 288 | 303 | 263 | 278 | 292 |
| Hay .. .. | — | — | 204 | 204 | 204 | 233 | 232 | 225 |
| Fat cattle .. | Live cwt. | 141 2 | 298 | 297 | 287 | 281 | 285 | 275 |
| Fat cows .. | ,, | 81 1 | 218 | 220 | 231 | 217 | 217 | 223 |
| Fat sheep .. | lb. d.w. | 2 11 | 280 | 280 | 275 | 275 | 275 | 269 |
| Fat ewes .. .. | ,, | 1 10 | 282 | 276 | 267 | 276 | 270 | 261 |
| Bacon pigs .. | Score | 57 4* | 376 | 376* | 376* | 360 | 360 | 360 |
| Pork pigs .. | (20 lb.) | 60 8* | 359*‡ | 359*‡ | 359* | 306 | 306 | 306 |
| Sows .. .. | d.w. | 28 8 | 249 | 249 | 249 | 250 | 248 | 248 |
| Milk .. .. | Gallon | 2 2.3* | 268* | 203* | 202* | 263 | 202 | 202 |
| Butter .. .. | 12 lb. | 36 0 | 171 | 171 | 171 | 143 | 143 | 143 |
| Poultry .. .. | — | — | 259 | 265 | 241 | 277 | 272 | 270 |
| Eggs .. .. | 120 | 39 4½* | 211 | 222‡ | 217* | 197 | 215 | 220 |
| Store stock† | | £ *s. d.* | | | | | | |
| Dairy cows .. | Head | 57 5 0 | 203 | 207 | 212 | 194 | 194 | 196 |
| Store cattle .. | ,, | 43 17 0 | 289 | 293 | 301 | 247 | 265 | 268 |
| Store sheep .. | ,, | 8 2 6 | 300 | 300 | 300 | 303 | 318 | 291 |
| Store pigs .. | ,, | 9 11 8 | 493 | 514 | 509 | 415 | 449 | 455 |

* Provisional † Not included in general index ‡ Revised figure

## FARMING AFFAIRS

**The Uneven-span Glasshouse** The designer of an efficient propagating glasshouse has two main objects in view—to protect the plants from cold, and to expose them as much as possible to sunshine in winter and early spring. Nevertheless, when trying to achieve the second of these objects, the designer finds that much of the sunlight falling on the glass does not pass through to the plants, but is reflected up again into the sky, because only light meeting glass at right angles passes through it. The problem is, therefore, to design the house so that the glass on the sunny, or south, side will be as nearly as possible, at right angles to the sun's rays.

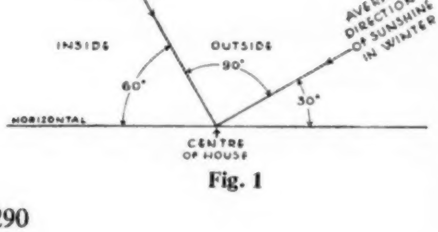


Fig. 1

In winter and early spring the sun's rays reach the earth in Britain at angles to the horizontal which vary greatly both with the period of the year and the time of day ; but it has been found that, on average, the sun's elevation is 30 deg. It follows that the glass should be at right angles to that direction, that is, at 30 deg. + 90 deg., or 120 deg., to the horizontal, outside the house, and at 60 deg. to the horizontal, inside. Fig. 1 helps to make this clear.

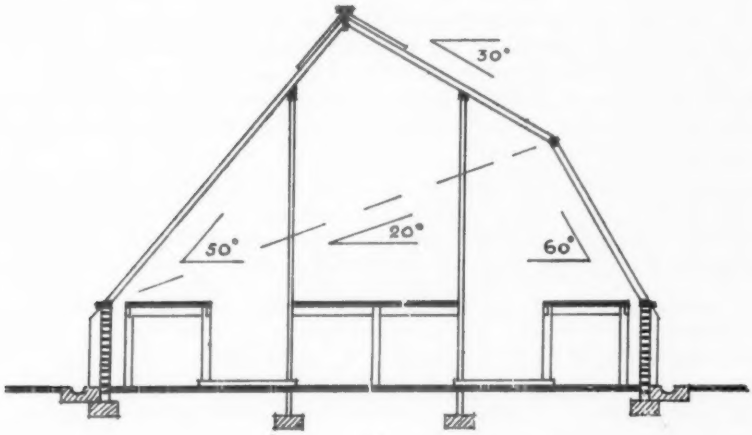


Fig. 2

As a rule, glasshouses are built with their glass at an angle of less than 60 deg. to the horizontal inside, and are symmetrical or of even span. The problem of obtaining this angle of 60 deg. could be solved by constructing the house so that the angles would be 60 deg. on the south side, 50 deg. on the north side and 70 deg. at the apex, but the house would then be too high. The solution is to carry up the south side at an angle of 60 deg. for approximately half its height, and thence to the apex at 30 deg., as shown in Fig. 2. Such a glasshouse is of uneven span—hence the name.

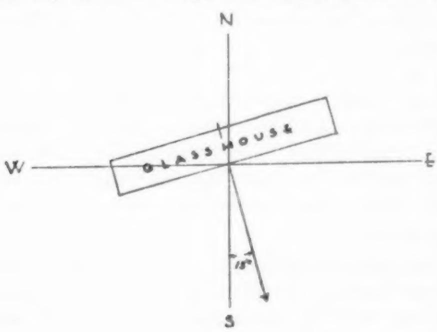


Fig. 3

One other point to remember when trying to get maximum exposure to sun in winter is, that the house should be placed so that the south side will receive the best of the daily sunshine. The best direction for the house to face is approximately due south—to be precise, 15 deg. east of south, as shown in Fig. 3.

N. K. Green

**Wise Stock Feeding :**
**7. Steaming Up for Autumn Calving**

It is well known that among the many factors influencing high milking capacity, adequate feeding in the last six weeks of pregnancy is of considerable importance. This applies to both cows and heifers, which, in this period, are faced with the tasks of replenishing or building up body reserves, developing or making good the wear and tear

on udder tissue, and providing for the very rapid growth of the unborn calf. Only by proper feeding can these demands be met and full production ensured in the subsequent lactation.

The practice of preparing the in-calf cow or heifer for lactation is known as "steaming-up," and it generally begins about six weeks before calving, when concentrates are introduced into the ration at the rate of 3 lb. daily. The allowance is then stepped up gradually throughout the remainder of the period, so that by the last week of pregnancy the cow receives no less than 50 per cent of the ration she will require after calving. Thus a cow expected to yield 5 gallons at the peak of her lactation would have in the final week before calving about 10 lb. of concentrates in addition to her maintenance ration. With heifers of unknown milking capacity, it is probably a wise policy to feed a little less lavishly, limiting the allowance to 6 lb. per head daily at the most.

The type of concentrate used for steaming up is largely a matter of choice, and any of the proprietary compounds balanced for milk production are satisfactory. Equally suitable are the following mixtures, in which the proportions of the ingredients are expressed as parts by weight :

(a) 5 parts cereals *plus* 1 part decorticated groundnut meal or decorticated cotton cake ; *or*

(b) 3 parts cereals *plus* 2 parts beans, peas, or linseed cake.

These rations are approximately balanced for milk production at the rate of 4 lb. per gallon. Cereals are usually deficient in essential mineral constituents, notably calcium and chlorine, and for this reason home-prepared concentrate mixtures should be fortified with either a suitable brand of proprietary minerals or a supplement consisting of 1 part by weight each of finely ground chalk and sterilized bone-flour, and 2 parts of common salt. This supplement should be intimately blended with the concentrate ration at the rate of 3 lb. per cwt.

Among the more common naturally-balanced foods are high-grade dried grass or lucerne meal, bran and palm kernel cake. Any of these may, with advantage, be added to the rations suggested earlier. Bran is of special value in that it possesses laxative properties, and its use as a mash in the week immediately before calving can always be recommended. In addition to being of the right quality, two requirements which the ration must fulfil are that it should always be slightly laxative and readily acceptable to the cow. Kale and silage have not given such good results as concentrates when used alone for steaming up, but their feeding value is beyond doubt and there is no reason why they should not be fed in quantities of up to 40 lb. daily, or even more if the cow is still able to eat her allotted share of concentrates. Being succulent, kale and silage help to counteract any constipating tendencies of the concentrate ration.

The magnitude of the response to steaming up will obviously depend on the individual cow and the adequacy of feeding, but it is generally reckoned that the use of 1½–2 cwt. concentrates will be rewarded by an increased production of between 50 and 80 gallons of milk.

Steaming up also helps to develop the cow's digestive system, thereby enabling her to deal more readily and efficiently with the heavy after-calving ration, and it is further claimed that it tends to prolong the active lactation of persistently low-milking cows, when this trouble arises from shy feeding or limited digestive capacity. There are no grounds for believing that the practice has a beneficial effect on milk quality, but *underfeeding* in the dry period to such an extent as to cause a decline in body condition may bring

about a lowering of the solids-not-fat content of the milk.

A possible consequence of steaming up is that it may cause the cow to come into milk before calving. In this event, she should be milked out to relieve udder tension and discomfort, and to avert a later drop in production. It is essential that once this has been done the cow should be milked regularly in accordance with standard practice.

W. Lewis

**Farming Cameo :**
**34. East Hertfordshire and Barnet**

This district is bounded to the east and south by Essex and Middlesex and to the west and north by a line drawn from Elstree to Stevenage and thence to Harlow. The latest returns show that it totals 83,000 acres split up into 1,065 holdings, 679 of them over five acres. The soil types are many and varied, two or three sometimes occurring within one field—a feature for which Hertfordshire is famous.

Examining the main soil types we find, in the north and east of the district, good, chalky, boulder clay on which the farms are large and mainly under well-managed, conventional arable crops, often with a dairy herd to take care of the by-products. Coming farther south to Hertford and Hatfield, there is a belt of glacial gravel soil, inherently hungry and liable to "burn" at its eastern end, but boasting the much prized " Hatfield loam "—a sandy clay of good depth —at its western extremity. The farms on this soil are also of a good size and nearly all carry a dairy herd. Here sugar beet and lucerne are of prime importance, beet forming the pivotal crop in the rotation and lucerne being grown as a drought insurance and provender provider. This part of the district is well wooded and rabbits are a menace on some farms, necessitating a constant fight to keep their numbers within bounds.

The gravel area represents the southern extremity of the glacial drift, and farther south in the Barnet-Potters Bar region, we come on to older soils, chiefly London Clay with occasional pockets of pebble gravel. London Clay soil is tenacious and greasy, difficult to work, inherently very acid, ill-drained and short of phosphate. The farms on this soil are much smaller in size and the dairy cow has pride of place. During the war a considerable acreage was kept under the plough, but much of this has now been returned to grass. Undoubtedly, with small farms, small fields and lack of suitable tackle, the best future for this area lies in well-managed grass. Where one or two well-equipped farmers have won this soil round, it has proved to be highly productive, but capital expenditure has been prodigiously high. The pockets of pebble-gravel referred to are truly foul soils with a rapacious appetite for lime and all other things, and with a bad habit of "spewing" water on to the surface. Fortunately,the area is small.

The whole district is intersected by the valleys of the river Lea and its tributaries, Stort, Ash, Rib, Beane and Mimram, the alluvial soils in the valley floors generally being in poor-quality grass. It was the practice in the heyday of the horse to mow these riverside meadows each year, the hay going into London. This has resulted in soils unbelievably short in phosphate and potash. Once this deficiency is recognized and courage gained to plough, crop and reseed, production can be increased many times over. The Lea Valley itself is famous for its glasshouse industry, centred on Cheshunt ; it is reputedly the largest concentration in the world, there being in all 650 acres under glass in Hertfordshire.

The dairy cow plays a very important part in the farming of the district, and some very famous herds of fine cattle are to be seen. An enlightened

grassland policy is pursued by many farmers, and self-sufficiency is no dream to some of them. Pigs, too, have a place, the Essex being the most popular with the Wessex close behind. The Large White × Saddleback pig is also held in great esteem as a feeder. Much use is made of swill by some pig-keepers. Sheep, alas, hardly hold their own. Few are to be seen, although this is perhaps not surprising in a county where there are two licensed dogs to every sheep !

The nearness of the district to London, with its ever-spreading suburbs, constitutes a serious agricultural problem ; over 1,000 acres of this district were lost to farming in the last twelve months, and, in addition, the town population are sometimes responsible for much damage to crops and equipment in the countryside around.

One feature of this district worthy of mention is the steady influx of business and professional men into part-time farming. They now form a fair proportion of the farming population.

P. A. Naylor,
*District Advisory Officer*

**Wheat Blossom Midges** Farmers often ask if pests are more numerous now than they were fifty or a hundred years ago. Usually the reply has to be that we just do not know because there were few entomologists in those days and accurate records were not kept. In the future, however, we shall at least have some information to guide us as a result of observations on the fluctuations of various pests, and one of the leading workers in this field has been Dr. H. F. Barnes of Rothamsted, who has made a special study of the Gall Midges (*Cecidomyidae*). These are a family of flies of very uniform appearance but of very diverse habits. They are all small delicate flies, about one-eighth of an inch long and often with yellowish or reddish bodies. As their name implies, many species are responsible for gall formation on various plants. Some species feed on decaying matter, and others may be beneficial by feeding on such pests as aphids and red spider mites.

Of the species attacking agricultural crops in this country, the Wheat Blossom Midges are the most important, though it is only occasionally that the farmer notices them. There are two species, *Contarinia tritici* Kby, and *Sitodiplosis mosellana* Geh. The midges first appear when the wheat is just beginning to shoot, and after mating the females lay their eggs in the ears. The little orange or lemon-coloured maggots hatch soon afterwards and feed in the flowers or on the developing grain. During July they can be shaken out of some ears in most wheat fields. After feeding for about a month, they descend to the ground, where they remain in a quiescent state over the winter in a cocoon, and pupate the following spring before emerging as adults.

In *New Biology No.* 14* Dr. Barnes has given a popular account of more than twenty-five years' work on these pests. It is rarely that a research worker has the opportunity of studying a pest for such a long period under the relatively uniform conditions as occur on the permanent wheat plots on Broadbalk at Rothamsted, but even given these opportunities one wonders how many entomologists would have seized them and patiently continued their observations year after year for more than a quarter of a century. The chief importance of Dr. Barnes's work is not so much in his careful observations of the life history, habits and natural enemies of the midges, but in the fact that he has established the existence of population cycles which reach

* Penguin Books. 2s.

a peak about every fifth year unless some local catastrophe, such as a thunderstorm, intervenes at a critical moment in the life history of the midge. Although Dr. Barnes is cautious in his conclusions, it seems that in the years when he anticipates (and usually records) a heavy infestation on Broadbalk, serious attacks also occur all over the country and, indeed, in other parts of the world. Many people will recollect the reports of damage during the last epidemic in 1951.

Another interesting observation is that not all the midges pupate and emerge in the spring after they have left the wheat plant. Many come out in the second year, others in succeeding years, and in one species emergence of adults from one season's maggots has continued over a period of twelve years.

The question that the farmer will ask is what loss in yield results from the attacks of the midges, but unfortunately Dr. Barnes cannot tell us very much about this. One species actually prevents the formation of a grain, and the feeding of the other species results in the grain being shrivelled, but it would seem to be important to discover the actual losses in yield in various parts of the country in different seasons, and it is to be hoped that this aspect of the problem, together with other questions prompted by Dr. Barnes's stimulating article, will soon receive attention.

H. C. Gough

**Antibiotics for Animal Feedingstuffs** From September 1, 1953, the antibiotics, penicillin and aureomycin (the latter in a restricted form) can be supplied for use in the food of pigs and poultry, subject to certain safeguards. Hitherto, the use of these antibiotics for feeding to animals has been subject to specific prescription by veterinary surgeons. The antibiotics will be available in two forms : (*a*) as a concentrated or compound feedingstuff to which the antibiotic has been added before sale to the farmer ; and (*b*) as a supplement which can be mixed, in accordance with directions given on the label, by the farmer who prepares his own feedingstuffs.

Under the Therapeutic Substances (Supply of Antibiotics for Agricultural Purposes) Regulations, 1953, the Agricultural Ministers have power to require that certain information shall be given on the labels that must be attached to every container of an antibiotic supplement or bag of feedingstuff containing an added antibiotic. Model forms of label have now been approved. These give information about the antibiotic and the storage and use of the product. The labels also bear warnings against feeding to ruminant animals and to stock used for breeding. Farmers who wish to test out antibiotics under their own conditions of feeding and management, either as supplements or as additions to compounds and concentrated feedingstuffs, are advised to follow the recommendations of the manufacturers about the rate of dosage and manner of use of the particular type of product they have bought.

Specimens of the approved forms of label have been sent to the associations representing merchants and manufacturers, but should any individual manufacturer require information about the labels he should get in touch with the appropriate Agricultural Department.

# BOOK REVIEWS

**Research for Plenty.** Eight Broadcast Talks. Introduction by JOHN GREEN. Geoffrey Bles. 5s.

The population of the world today is estimated at about 2,500 millions, and apparently it is increasing by some 25 millions a year. This increase may not be greatest in the continents to which it is popularly attributed. On the authority of Dr. Stamp, for example, the peoples of the United States are increasing faster than those of India, owing to their higher survival rates, and he has demonstrated, even more astonishingly, that amongst the English-speaking white races the rate of increase is four times that of the world as a whole.

Famine was endemic in Britain until almost the end of the Middle Ages ; it is endemiy in great areas of the world today. What can be done by scientific research, mainlc biological, to meet the yearly increasing demands for food? This problem has recently been ventilated by the B.B.C. in a series of eight broadcast talks* delivered by a group of agricultural biologists, each of them specialists in one or more of the processes by which man is adapting Nature to the greater satisfaction of his needs. Sir James Scott Watson points out that this concern for future generations is something very recent. Progress in the technique of farming might be quicker if organized in larger units of production, like the great manufacturing industries ; but the vast majority of the farmers of the world are illiterate peasants, working on uneconomic land units, where tradition perhaps centuries old is the only guide. Sir James asks whether more might not be done to exploit the vast areas of uncultivated land ; of undrained marsh and unreclaimed forest. Cannot we find new plants which are more efficient manufacturers of sugar from air and water ? Indeed, need we rely upon the green plant at all for this wonderful conversion ? Could not the chemist, working in a factory, synthesize all the edible fats and other foods, and thus cut out much of the farmer's toil ? The answers to his questions must be sought by the reader, but it is clear that he does not look for salvation along these lines.

Those following him develop these and other themes. Dr. Eric Ashby puts poor husbandry first amongst the obstacles—exhausted soils, the ravages of pests and diseases, and so forth. Mr. F. C. Bawden points out, too, how plant diseases are largely due to man's interference with plant ecology. Then there is the work of the plant physiologists, producing drought-resistant and frost-resistant varieties of crops, which push the agricultural frontier nearer to the desert on the one hand and nearer to the Arctic Circle on the other. Dr. E. W. Russell points out what a small fraction of the Earth's surface is actually in tillage ; mountain, desert, forest and ice account for the bulk. Can anything be done about it ? Dr. Norman C. Wright tackles the problem of herbage, which has remained the staple foodstuff for our livestock after 5,000 years of pastoral farming ; and the subject of pastoralism is further developed by Dr. Allan Fraser, particularly in relation to sub-Arctic regions.

How many of us ever give a thought to the wonder which makes fresh fish available in great quantity, variety and in regular supply to our tables daily, a favour enjoyed only by a few of the peoples of the world ? To most readers, Michael Graham's talk on the problems and potentialities of our sea larder will come as a revelation. Lastly, there is Mr. N. W. Pirie's talk on the prospects of increasing the variety of plants still waiting to be developed as food for man—more fungi, perhaps, and even bacteria.

Since this series of talks was arranged by John Green, a farmer himself and well-known to many listeners for his work for agriculture, it was very fitting that he should contribute an introduction to the book. It is a scholarly and thoughtful contribution, the link being, of course, the prospects for widening the world's food supplies.

The enterprise of the publishers in presenting these talks in book form it to be highly commended; the fact that they have found it possible to produce it so well and at such a low price is very creditable indeed.

*C.S.O.*

**Berkshire** (County Books Series). IAN YARROW. Robert Hale. 18s.

Berkshire is the latest edition to the story of the counties in the series edited by Mr. Vesey Fitzgerald. It is a county of sharp contrasts. From Royal Windsor in the east, it passes through a big residential district of sand, heather and pinewoods westward to industrial Reading, and thence still westward in two great parallel districts, the chalk downs and the

* These talks were reproduced in AGRICULTURE over the months November 1952, to June 1953.

Vale of the White Horse, to the Wiltshire border. The Thames forms a natural boundary on the north. Mr. Yarrow leads his readers by way of pre-history from the story of the ancient men, their habitations, burial grounds and trackways, to recorded times, when the great Abbeys of Reading and Abingdon dominated so much of the county, and John Smallwood, better known as Jack of Newbury, the clothmaker, was making industrial history in the sixteenth century. The two battles of Newbury come in for mention and the story of the scouring of the White Horse is told again.

The rest of the book is concerned more with recent events, a Berkshire scrapbook of local wit and wisdom, the social institutions of the past century or so, the feasts, revels and fairs, some of which have hardly yet passed out of living memory. There is much about the natural history of the county, and the book concludes with a chapter on the open road, a guide for motorists anxious to explore this most rewarding county, more essentially English and satisfying to many of us than some of the spectacular districts so much better known to tourists.

On the whole, Mr. Yarrow has done his task well. Such a book must inevitably be selective, but there are some regrettable omissions and some inaccuracies less excusable. The Newbury suburb of Speenhamland is mentioned, but the author has nothing to say about the great part played at the end of the eighteenth century by the Speenhamland Act, a landmark in the history of the agricultural worker and the Poor Law. There is no mention of the Newbury Field Club, an archaeological and natural history society with an honourable record since 1870. The Loddon Lily is the summer Snowflake, *Leucojum aestivum*, not, as the author says, the Fritillary. There is no mention of the interesting Spiked Star of Bethlehem, *Ornithogalum pyrenaicum*, the Opium Poppy, the Solomon's Seal, or of the great variety of orchids to be found on the chalk downs ; there is a passing reference to the Pasque Flower, *Anemone pulsatilla*, but nothing is said of the pleasing legend that it grows only where Danish blood was shed. To claim, too, that the Berkshire Downs once supplied nearly all England with wool for cloth-making is surely an overstatement.

Mr. Yarrow's book is delightfully illustrated by photographs. Parts of it were obviously written some time before publication, and these show how quickly the face of the country is changing under post-war development. He speaks of the Atomic Energy Research Establishment, at Harwell, as a project, but already it has spread into several parishes, deeply affecting the social life of the locality. Beautiful Greenham Common is submerged once more under occupation of the American Air Force ; on the other hand, the flooding of the Enborne Valley to augment London's water supply, and the erection of a television station on White Horse Hill no longer threaten.

*C.S.O.*

**Weed Control** (2nd Edition). WILFRED W. ROBBINS, ALDEN S. CRAFTS and RICHARD N. RAYNOR. McGraw-Hill. 57s. 6d.

When *Weed Control* first appeared in 1942 it was undoubtedly the most important book which had been published in this field for more than a decade. Not only did the contents embrace a balanced review of the merits of cultural and chemical means of weed eradication, but there was much new information concerning the many and varied investigations undertaken by the authors in California. Yet within three years the book was largely out of date, for 1945 ushered in the era of synthetic growth regulators as potent and selective herbicides. Since then the pace of development has been fast and furious ; many new compounds have been acclaimed as even better herbicides, many have failed to live up to the initial expectations and there has been a mounting torrent of papers and articles, some scientific and others more concerned with the exploitation of individual herbicides.

In the early post-war years, it would have been impossible to have attained any balanced judgment of these new developments, and the authors have wisely waited until some of the dust of conflicting claims has settled before publishing this second edition. Even now, it is almost impossible for any book to be completely up to date since several hundred papers from all parts of the world appear each year, and yet the authors have managed to include an initial assessment of most of the latest compounds.

From the more practical aspects, the authors stress the efficiency and performance of the several major herbicides under American conditions, and it is by now well established that measures which may be appropriate in one country or region may not be applicable in Britain. Nevertheless, for all those who want a conspectus of the scope of weed control and possible methods of application this book will provide it. The contents will particularly appeal to university students, to those working in an advisory capacity and research workers engaged in other fields of investigation. The expert, within the field, may question whether the discussion of the physiological and selective action of herbicides at the level of a "text-book and manual" has completely escaped the pitfalls of over-simplification.

*G.E.B.*

**East Malling Research Station Annual Report, 1952.** 12s. 6d.

This four-fold report contains an account of the season's work at the Station's experimental farm ; a general review of research which covers most aspects of fruit culture ; a series of 27 research papers, which, though technical, will nevertheless interest growers who like to know what progress is being made in fruit research ; eight bulletins for fruit-growers, dealing with practical applications of current investigations, and a useful index of over 500 entries. An indication of the wide range of topics which are reviewed, or reported in detail, may perhaps be obtained from the following brief notes.

Five new apple rootstocks (Malling-Merton) emerging as the result of thirty years of selection have been distributed to commercial growers for propagation. Trees on these rootstocks should be available to fruit-growers by 1957, for further selection according to their suitability for different localities. These have better propagation and bearing qualities than the earlier Malling rootstocks ; moreover, they are resistant to Woolly Aphid. One of them (M.XXV) is less resistant, but appears likely to make a very vigorous tree and particularly to induce the early development of fruit buds and the setting of fruit. The characteristics of each rootstock are clearly described with some excellent photographs.

The Fifth Amos Memorial Lecture delivered by Professor H. B. Tukey, printed in full in the report, deals with research developments in fruit culture in America. Apparently, in America only 20-25 cents of the consumer's dollar ever reaches the fruit-grower, the remainder being absorbed in the cost of handling, packing transport and selling. The fullest use is made of labour-saving devices, such as machines for planting strawberries, the use of chemical sprays for blossom thinning in place of thinning by hand, etc. Mulching of fruit is regarded as highly important.

One of the research reports deals with the susceptibility to spring frosts of different blackcurrant varieties. They appear to be most susceptible at the "grape" stage but thereafter resistance increases as the blossoms open. This may explain some of the variations in frost damage from year to year, according to the earliness or lateness of varieties and of spring frost incidence.

An article of special interest to plant physiologists serves to illustrate the widely different types of information which make up the report. The uniform nutrition of trees in experimental work, in which factors other than nutrition are under study, is often interfered with because trees of different growth rates exhaust the soil or water culture solution at different rates. A novel method, in which fruit tree roots are supplied with nutrients in the form of a mist produced on the scent spray principle, is described and illustrated.

Many of the reports and reviews are of general interest to the practical fruit-grower. A typical instance describes the effect of insecticide sprays on predators of the Fruit Tree Red Spider mite, in which it is shown that the residual effects of DDT are likely to kill the incoming predators on Red Spider mite, such as the Black-kneed capsid, so that mite infestation eventually becomes much greater on trees sprayed with DDT than on unsprayed trees—the Red Spider mite appearing to be less affected by the *residual* effects of DDT than its predators. The organo-phosphorous insecticides appear to act similarly.

A report on strawberry varieties emphasizes the value of Royal Sovereign as a high-quality early variety, provided it is not grown anywhere near virus-carriers. The merits of eight varieties are discussed. The report also includes instructions on a simplified technique for the double working of pears on quince rootstocks at budding time and a number of papers on virus and other diseases of fruit and hops.

*A.J.L.L.*

**Annual Report of the Forestry Commissioners** (September 1952). H.M. Stationery Office. 3s.

The thirty-third annual report of the Forestry Commissioners makes very interesting reading and offers a wealth of figures of silvicultural interest. The net area of land acquired by the Commission during the year ended September 30, 1952, was 74,243 acres, and the year's planting of 61,632 acres was a record, exceeding that of the previous year by almost 4,800 acres. Of this total, nearly 40 thousand acres were new plantings. No less than 120 million young trees were planted, and nursery stocks reached the phenomenal figure of 184 million transplants and 315 million seedlings. The report records, as a timely warning to the careless, that there were 1,130 fires during the year—although it is only fair to add that 751 outbreaks were attributed to sparks from railway engines.

But the heart of this report reveals the way in which the Commissioners have tackled

the problem of equating the programme of expansion on which they have been engaged since 1945 with the urgent need for economy in national expenditure. That they have been able to maintain the existing plantations and yet achieve a record rate of planting without making any substantially larger calls on public funds than in the previous year, says much for the Commissioners' wise planning and efficient management. The magnitude of their performance is even more remarkable when we reflect that these results were obtained in a year which, apart from all the normal hazards, brought two disastrous hurricanes to north and west Scotland.

*L.W.T.*

**Report on Forest Research for the Year ending March 1952.** H.M. Stationery Office. 4s. 6d.

Received at the time of going to press.

**The Agricultural Research Service.** H.M. Stationery Office. 2s. 6d.

Not only to those people who are vaguely aware that an Agricultural Research Service exists, but also to those who wish to be better informed, this booklet will come as a welcome means of increasing their knowledge of the organization. It is one thing to have heard of Rothamsted, or even to have been there ; it is quite another to be told clearly of the many other stations, institutes and units scattered over England, Wales and Scotland, which are carrying out research in many branches of the agricultural field or working on the more fundamental problems.

The foreword by the Chairman of the Research Council defines the main function of the service as that of increasing the efficiency of food production in Great Britain. The reader will learn that private endowment nowadays meets only a small part of the cost of supporting the service, and that the remainder, approximately £3 million, has to be found by the State. To those who aim at making the service as efficient and complete as possible, this amount seems inadequate (0.3 per cent of the value of the agricultural output in 1951), but by what yardstick is the true amount really to be assessed ?

The detailed consideration of problems is expressed through a wide range of conferences and committees, and among the members of these bodies are to be found some of the most eminent men and women in pure and applied science.

It is presumably the view of the authors that the Agricultural Research Service covers only those institutions and projects receiving support through the Council, otherwise reference might have been made to the various research centres, such as the Ministry of Agriculture's Veterinary Laboratory at Weybridge and the Plant Pathology Laboratory at Harpenden.

*W.M.D.*

**A Guide to the Practical Design of Installations.** (Farm Electrification Handbook No. 3.) British Electrical Development Association. 2s. 6d.

Farmers, land agents and all concerned with electricity in rural areas will welcome the appearance of this useful and practical little book. It is written in language which makes a technical subject understandable to the layman, but is, at the same time, authoritative, and electricians will read it with profit. This is the third handbook in a series devoted to aspects of farm electrification and is the product of an expert team from those valuable friends of farming, the British Electrical Development Association. It is of handy size, in spite of its 80 pages, and is splendidly illustrated with clear and definite photographs. The chapters on lamps and lighting fittings will repay study before installing an electricity supply. Especially to be commended to the reader's attention is the appendix showing some typical farm lighting layouts. The arrangement of the layout is clearly presented by the simple use of red symbols, and it should do much to prevent the rather makeshift arrangements which one sometimes sees on farms where insufficient thought has been given to this point.

Electricity is a service and must therefore be adapted to the particular needs of each farm. This requires careful thought if economy in material and cost and, at the same time, the maximum benefit to the user is to be achieved. The blessing of electricity is, happily, to be enjoyed by a greater number of farmers in the coming years. Its effect on the life of a farming family can be profound ; it literally makes work lighter. There is, therefore, an ample field for advisory booklets of this quality, and we await future booklets in the series with interest.

*R.G.A.L.*

## BOOK REVIEWS

**Antibiotics in Pig Food.** (Agricultural Research Council Report Series No. 13). H.M. Stationery Office. 1s. 6d.

This is an account of experiments carried out to ascertain the value of adding antibiotics, such as penicillin and aureomycin, to feedingstuffs for pigs kept under British conditions of feeding and management. The work was conducted at several research institutes, experimental husbandry farms, colleges and commercial farms, and each antibiotic was tested in rations with and without fishmeal, given to pigs from weaning up to bacon weight.

In the presence of fishmeal both penicillin and aureomycin increased the growth rate by about 10 per cent, and in its absence the effect was slightly more marked. The efficiency of food utilization was improved by about 7 per cent. Carcass quality was not affected by either antibiotic. The proportion of antibiotic required to produce these results was very small, being equivalent to 15 parts of pure antibiotic per million parts of food (about ½ oz. per ton).

Although these results are encouraging and have been followed by legislation which seeks to legalize the addition of penicillin and aureomycin to feedingstuffs for fattening pigs and table poultry, it is necessary to stress that they were obtained in *pig* feeding trials. Feedingstuffs containing antibiotics should be used only for the animals for which they are specifically intended, since they may produce undesirable effects in other classes of livestock.

*S.M.B.*

**Bulk Handling of Grain in the U.S.A.** H.M. Stationery Office. 1s.

This description of some of the methods by which grain is handled in bulk in America comes at a time when a growing interest is apparent in the possibilities of the application of more bulk handling methods in this country. The most striking feature to impress the mission which visited the U.S.A. in 1951 was the use made of ordinary standard lorries and all-purpose rail wagons. Very few specially designed vehicles were seen, but adaptation of lorries of all sorts and sizes by the simplest and cheapest ways allowed grain to be carried in bulk without restricting the use of the vehicles for return loads of different commodities.

Many farmers, faced with the urgent problem of using their available labour most productively, are prepared to consider any handling methods which will permit them to dispense with sacks. Bulk handling, particularly as far as delivery is concerned, is strange to them, and any information on the ways to tackle this change must be useful. This booklet will provide a useful starting point for thought. Conditions in Great Britain differ from those in America, but the American farmer's problems—harvesting, storage and disposal—are fundamentally similar to those of a farmer here, and the methods used in the U.S.A. could well be put into practice in Great Britain, provided the grain to be handled receives any necessary conditioning.

*A.L.*



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